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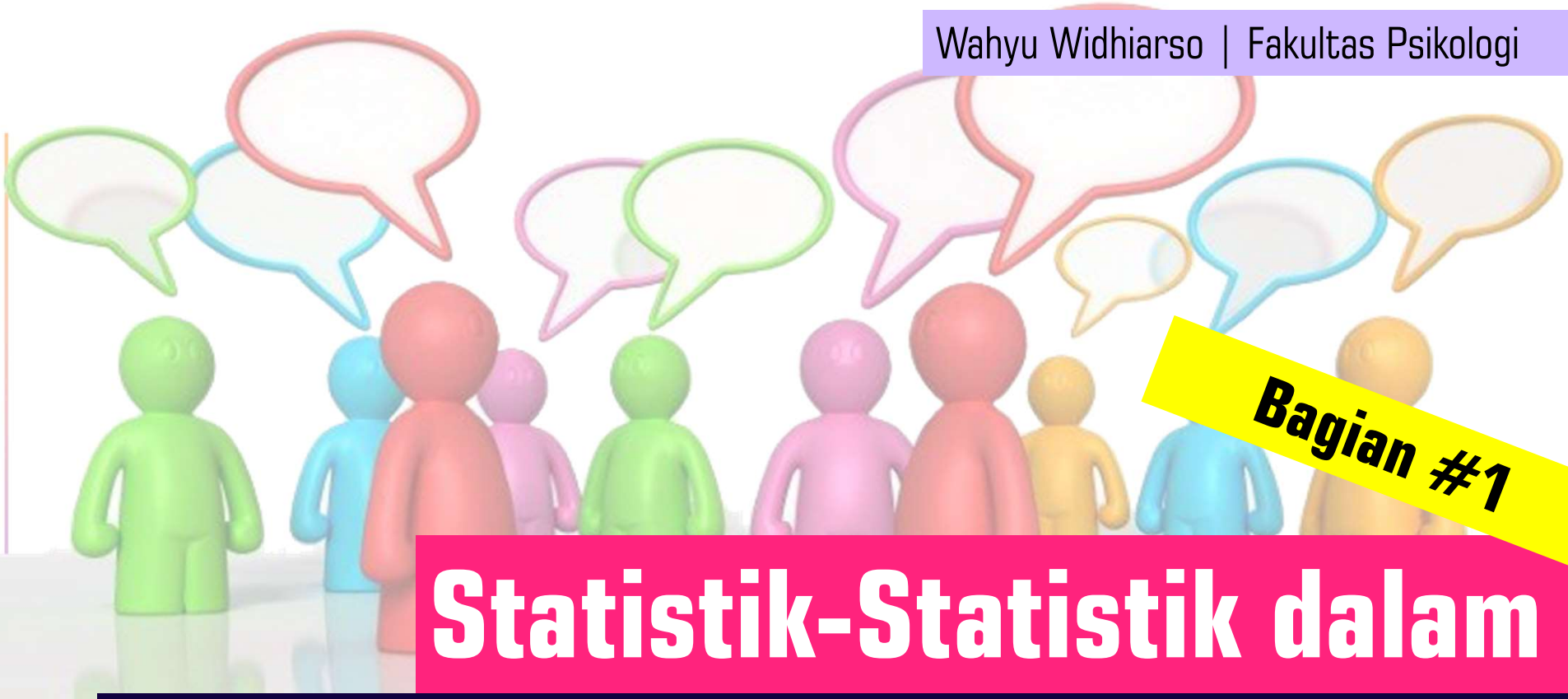


Bagian #1

Statistik-Statistik dalam

META ANALYSIS

STATISTIK-STATISTIK DALAM ANALISIS META

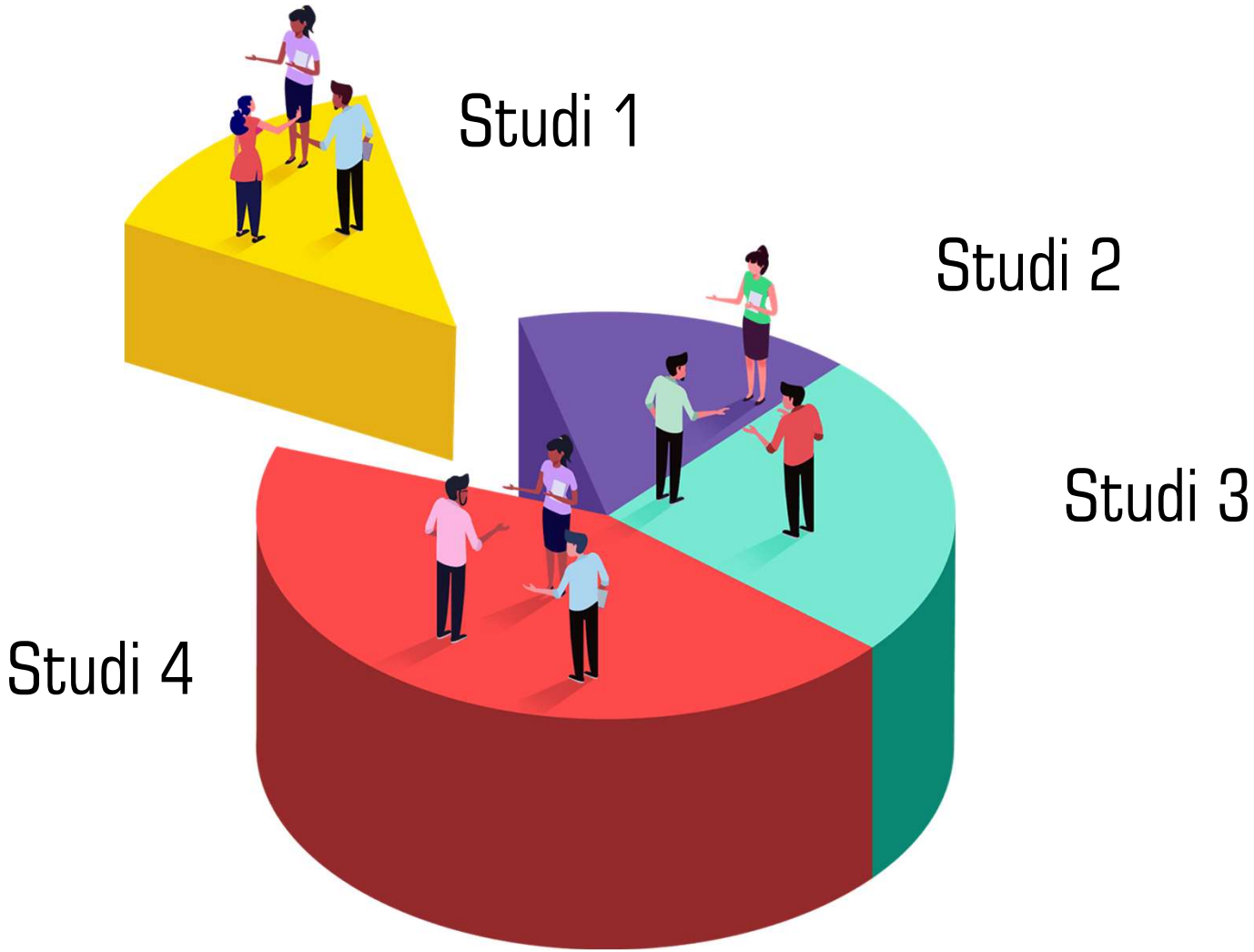
Wahyu Widhiarso | Fakultas Psikologi UGM

Pengertian

- Meta-analysis refers to the statistical analysis of the data from independent primary studies focused on the same question, which aims to generate a quantitative estimate of the studied phenomenon.

Prosedur Analisis Meta

Studi 1
Studi 2
Studi 3
Studi 4
Studi 5
Studi 6
Studi 7
Studi 8
dst

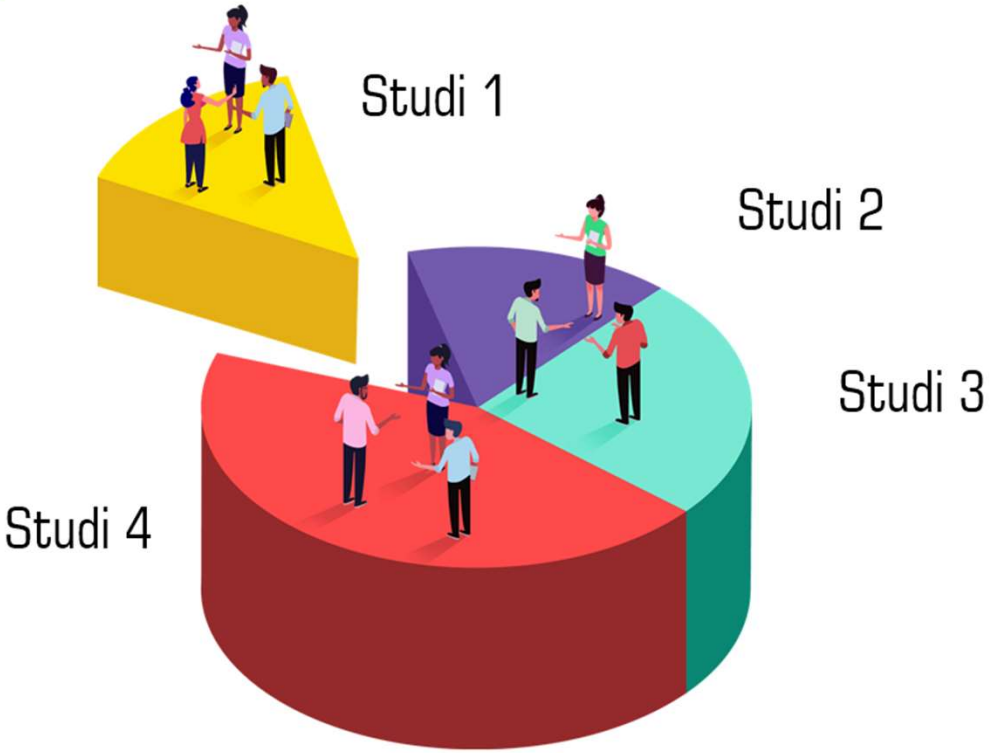

Studi 1
Studi 2
Studi 3
Studi 4

Contoh

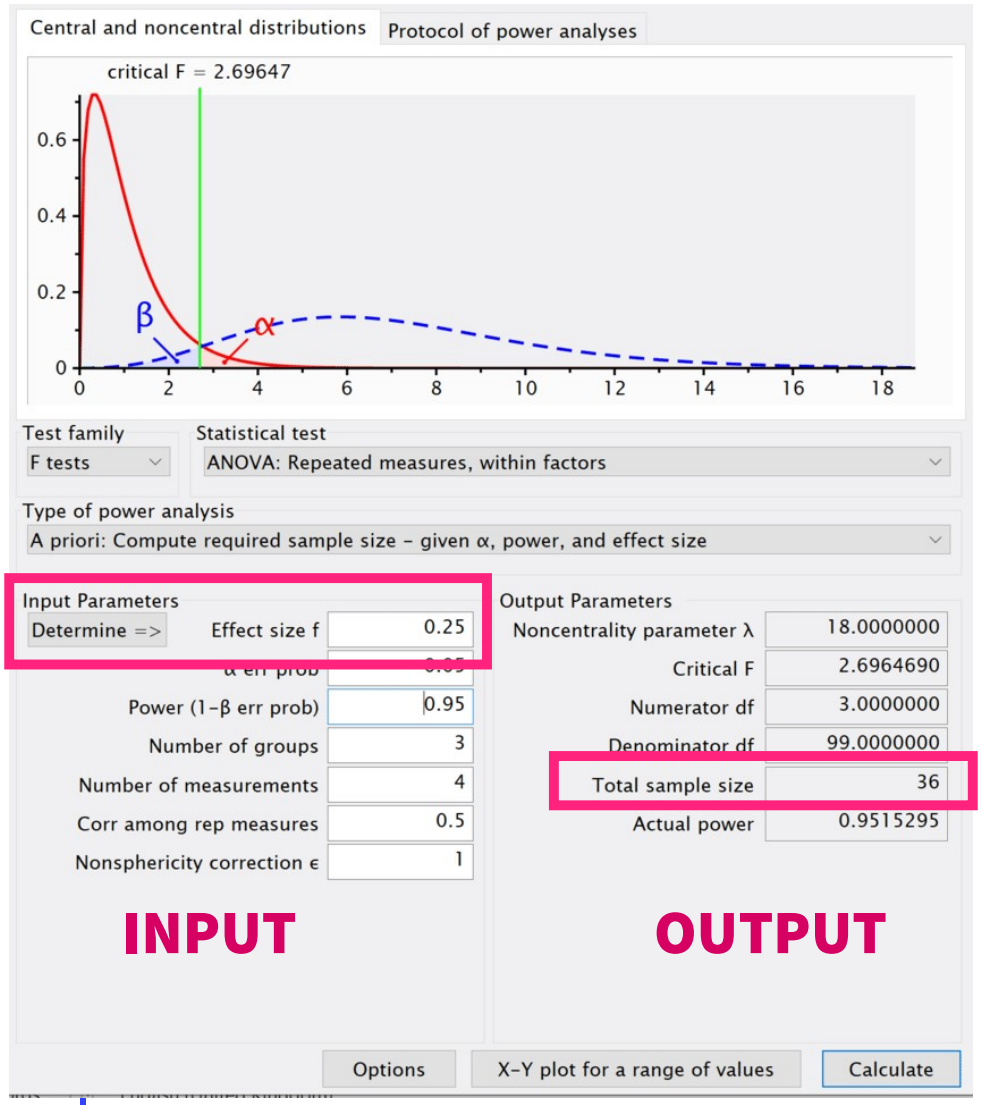
- Melakukan meta analisis pada 25 penelitian yang meneliti peranan faktor kepribadian terhadap prestasi kerja.

- Melakukan meta analisis pada 33 mengenai efektivitas terapi kognitif terhadap peningkatan well being

HASIL ANALISIS META



Komprehensif



Meta Analisis memberikan informasi awal yang sangat dibutuhkan untuk melakukan analisis dan prosedur statistika

Meta Analisis merupakan gerbang menuju penelitian yang sistematis dan memiliki pijakan yang kuat

CONTOH

Original Articles

The Relationship of Achievement Motivation to Entrepreneurial Behavior: A Meta-Analysis

Christopher J. Collins, Paul J. Hanges & Edwin A. Locke

Pages 95-117 | Published online: 12 Nov 2009

Download citation https://doi.org/10.1207/S15327043HUP1701_5

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Abstract

Entrepreneurship is a major factor in the national economy; thus, it is important to understand the motivational characteristics spurring people to become entrepreneurs and why some are more successful than others. In this study, we conducted a meta-analysis of the relationship between achievement motivation and variables associated with entrepreneurial behavior. We found that achievement motivation was significantly correlated with both choice of an entrepreneurial career and entrepreneurial performance. Further, we found that both projective and self-report measures of achievement motivation were valid. Finally, known group studies yielded a higher validity coefficient than did individual difference studies.

Previous article View issue table of contents Next article

The Relationship of Achievement Motivation to Entrepreneurial Behavior: A Meta-Analysis

Christopher J. Collins

LANDASAN #1

As was suggested by McClelland (1961), it seems likely that **individuals high in nAch** should be attracted to and perform well in **entrepreneurial jobs**.

The Relationship of Achievement Motivation to Entrepreneurial Behavior: A Meta-Analysis

Christopher J. Collins
Robert H. Smith School of Business
University of Maryland

LANDASAN #2

The magnitude of the relationship between achievement motivation and entrepreneurial activity

is unclear.

The Relationship of Achievement Motivation to Entrepreneurial Behavior: A Meta-Analysis

LANDASAN #3

In contrast to traditional reviews, **meta-analysis has the potential to address** some of these issues by quantitatively combining the results of individual studies to estimate the magnitude of the relationship

University of Maryland

INPUT

Data Input

Data Utama

- Ukuran sampel (n)
- Selisih rerata
- Varians (within, between)
- Koefisien korelasi

- Jika tidak ada
  - Koefisien t, F
  - Statistik effect size
  - Gambar plot

Kovariat

- Demografi
- Variabel kontrol
- Lokasi
- Setting
- dsb

Input berupa korelasi

Table III Descriptive statistics and correlation matrix for study variables – correlation matrix

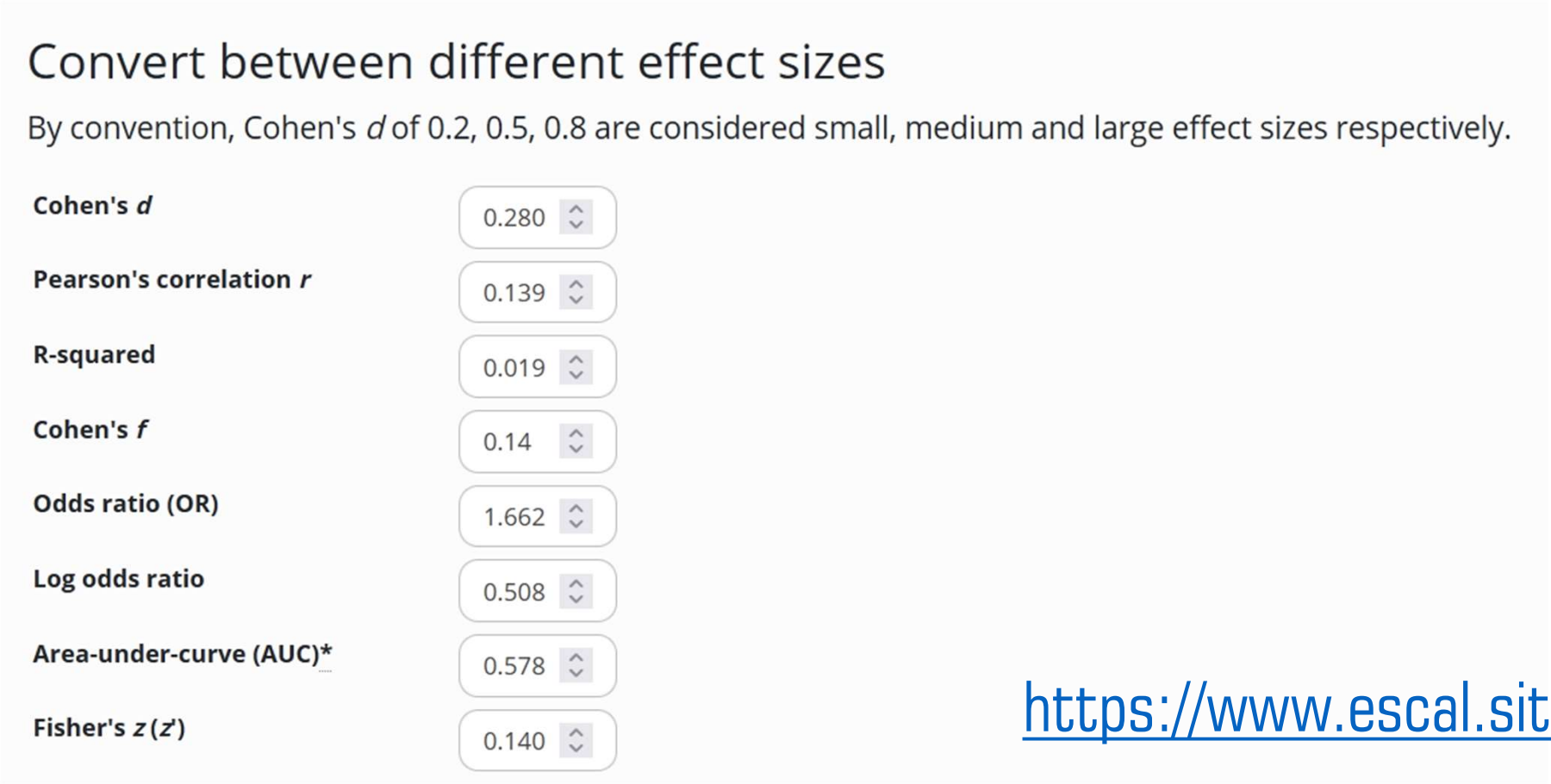
	MO	FP	MP	IM	IC	FM	FE	FI	SPC	DSC	DST
MO	1.00										
FP	0.31[a]	1.00									
MP	0.32[a]	0.71[a]	1.00								
IM	0.36[a]	0.12[c]	0.14[c]	1.00							
IC	0.39[a]	0.18[b]	0.21[a]	0.62[a]	1.00						
FM	0.26[a]	0.21[a]	0.14[c]	0.30[a]	0.27[a]	1.00					
FE	0.47[a]	0.21[a]	0.18[b]	0.38[a]	0.28[a]	0.24[a]	1.00				
FI	0.53[a]	0.26[a]	0.22[a]	0.36[a]	0.37[a]	0.29[a]	0.47[a]	1.00			
SPC	0.32[a]	0.22[a]	0.31[a]	0.51[a]	0.47[a]	0.32[a]	0.37[a]	0.35[a]	1.00		
DSC	−0.12[c]	0.03[c]	0.05[c]	0.17[b]	0.08[c]	0.18[b]	−0.05[c]	0.06[c]	0.01[c]	1.00	
DST	−0.02[c]	−0.01[c]	0.05[c]	0.24[a]	0.14[c]	0.05[c]	−0.05[c]	0.05[c]	0.05[c]	0.56[a]	1.00
DM	0.05[c]	0.144	0.136[c]	0.199[a]	0.169[b]	0.247[a]	0.08[c]	0.11[c]	0.14[c]	0.46[a]	0.71[a]

Notes: [a] correlation is significant at the 0.01 level (two-tailed); [b] correlation is significant at the 0.05 level (two-tailed); [c] correlation is non-significant

Nilai F

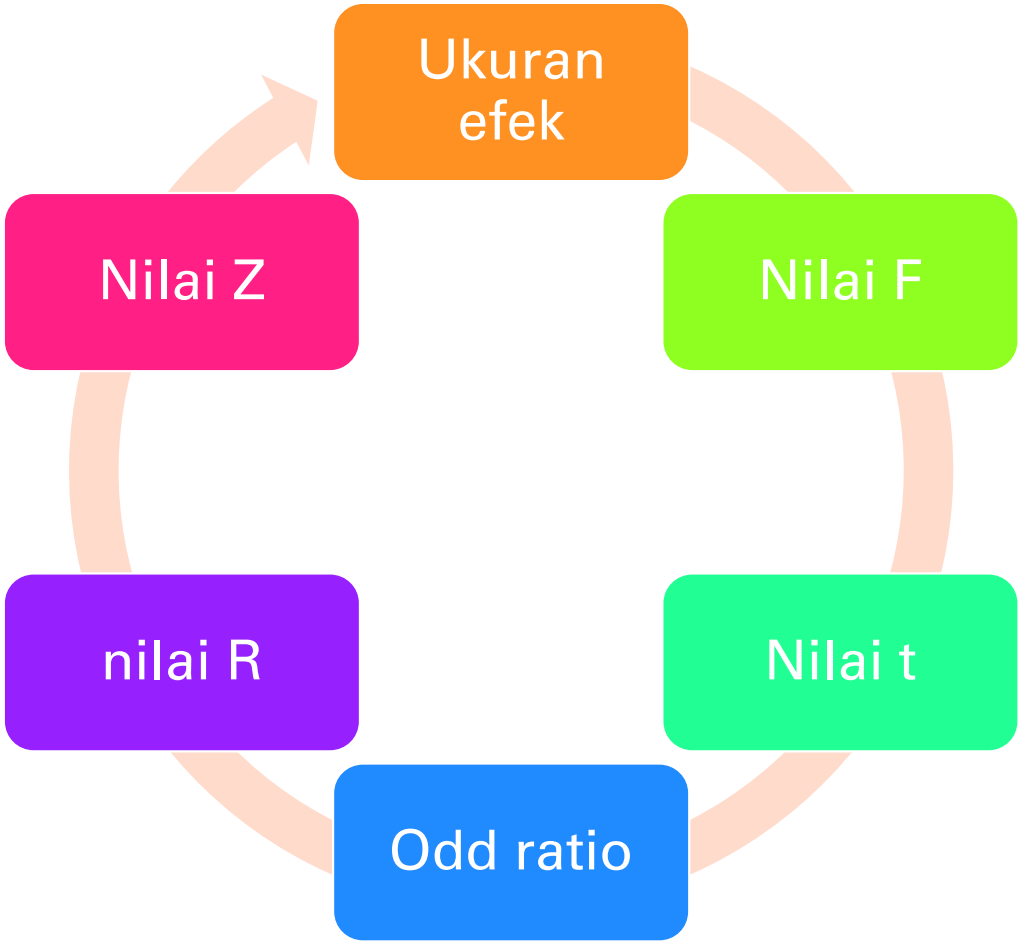
administration of the test and how well or poorly they thought they would do on the upcoming administration of the test (9-point scales from 1 = *very poorly* to 9 = *very well*). These data were subjected to 2 (social orientation) × 3 (performance) analyses of variance (ANOVAs). Main effects of performance feedback were obtained on both the prior performance item, $F(2, 135) = 343.33$, $p < .001$, $\eta^2 = .85$, and the expected performance item, $F(2, 138) = 77.85$, $p < .001$, $\eta^2 = .53$. All three performance conditions differed from one another on each item, because participants believed they did better and would do better in the success condition than in the control condition (*p*s < .001), and those in the control condition believed they did and would do better than those in the failure condition (*p*s < .001; *M*s for the success, control, and failure conditions, respectively, were 7.9, 5.2, and 2.7 on the prior performance item and 7.4, 5.7, and 4.3 on the upcoming performance item). No other main or interaction effects were obtained on these items (*p*s > .30).

Semua Statistik itu Sobatan



https://www.escal.site/

Cohen's *d*	0.280
Pearson's correlation *r*	0.139
R-squared	0.019
Cohen's *f*	0.14
Odds ratio (OR)	1.662
Log odds ratio	0.508
Area-under-curve (AUC)*	0.578
Fisher's *z* (*z'*)	0.140



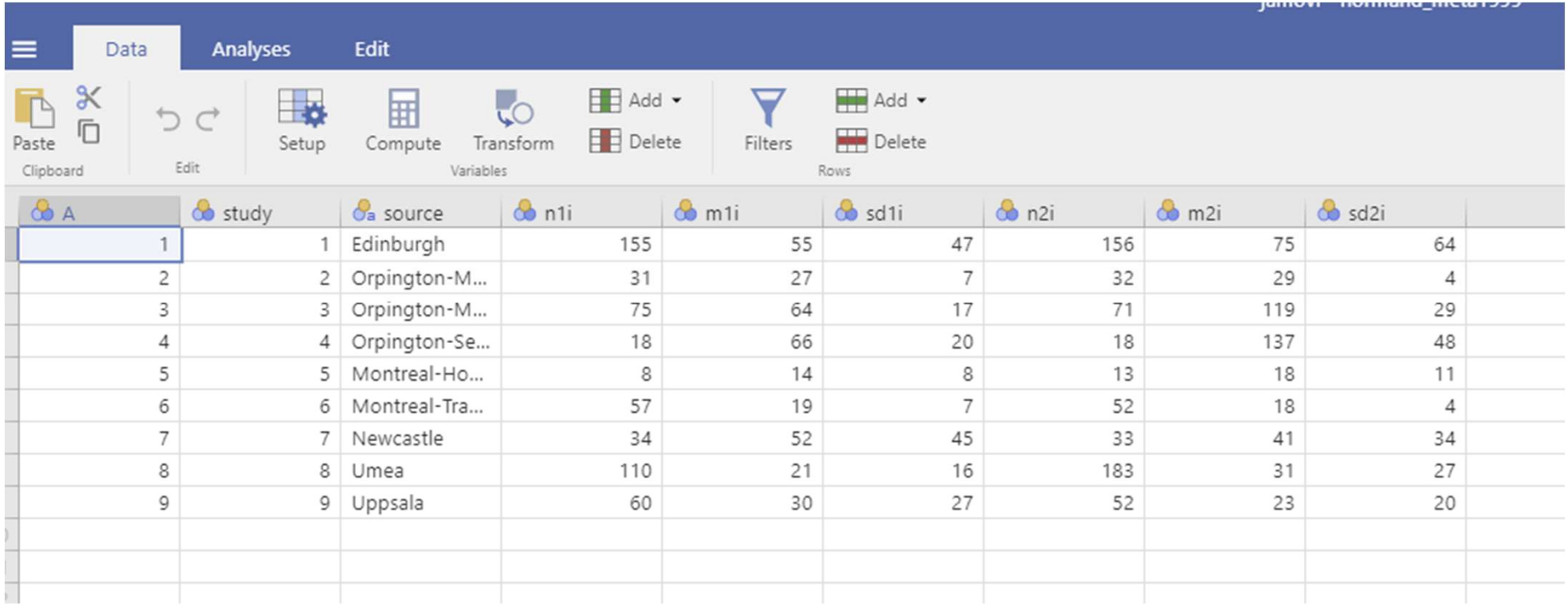
Input

Input

Study no.	Study name	N	Effect direction	r	SE	Variance	Fisher's Z	95% CI	SE	Variance	M_{Age}	Population characteristic
1	Feiring et al. (2002)	137	Negative	−.17	.08	0.007	−0.17	[−0.495,−0.258]	0.09	0.007	11.50	Clinical
2	Gao et al. (2013)	277	Negative	−.36	.05	0.003	−0.38	[−0.582,−0.103]	0.06	0.004	22.57	Nonclinical
3	Gao et al. (2013)	70	Negative	−.33	.11	0.012	−0.34	[−0.495,−0.258]	0.12	0.015	20.54	Nonclinical
4	Goss (2013)	179	Negative	−.56	.05	0.003	−0.63	[−0.620,−0.325]	0.07	0.006	27.20	Clinical
5	Goss (2013)	180	Negative	−.43	.06	0.004	−0.47	[−0.754,−0.601]	0.07	0.006	27.20	Clinical
6	Greene and Britton (2013)	657	Negative	−.59	.02	0.001	−0.68	[−0.835,−0.402]	0.04	0.002	34.89	Nonclinical
7	Legate et al. (2019)	484	Negative	−.63	.03	0.000	−0.74	[−0.784,−0.503]	0.05	0.002	28.40	Clinical
8	Passanisi et al. (2015)	209	Negative	−.57	.05	0.002	−0.65	[−0.784,−0.511]	0.07	0.005	21.66	Nonclinical
9	Pilarska (2018)	357	Negative	−.33	.05	0.002	−0.34	[−0.341,−0.002]	0.05	0.003	21.19	Nonclinical
10	Reilly et al. (2014)	145	Negative	−.55	.06	0.003	−0.62	[−0.783,−0.454]	0.08	0.007	26.01	Nonclinical
11	Simonds et al. (2016)	85	Negative	−.55	.08	0.006	−0.62	[−0.630,−0.339]	0.11	0.012	13.55	Nonclinical

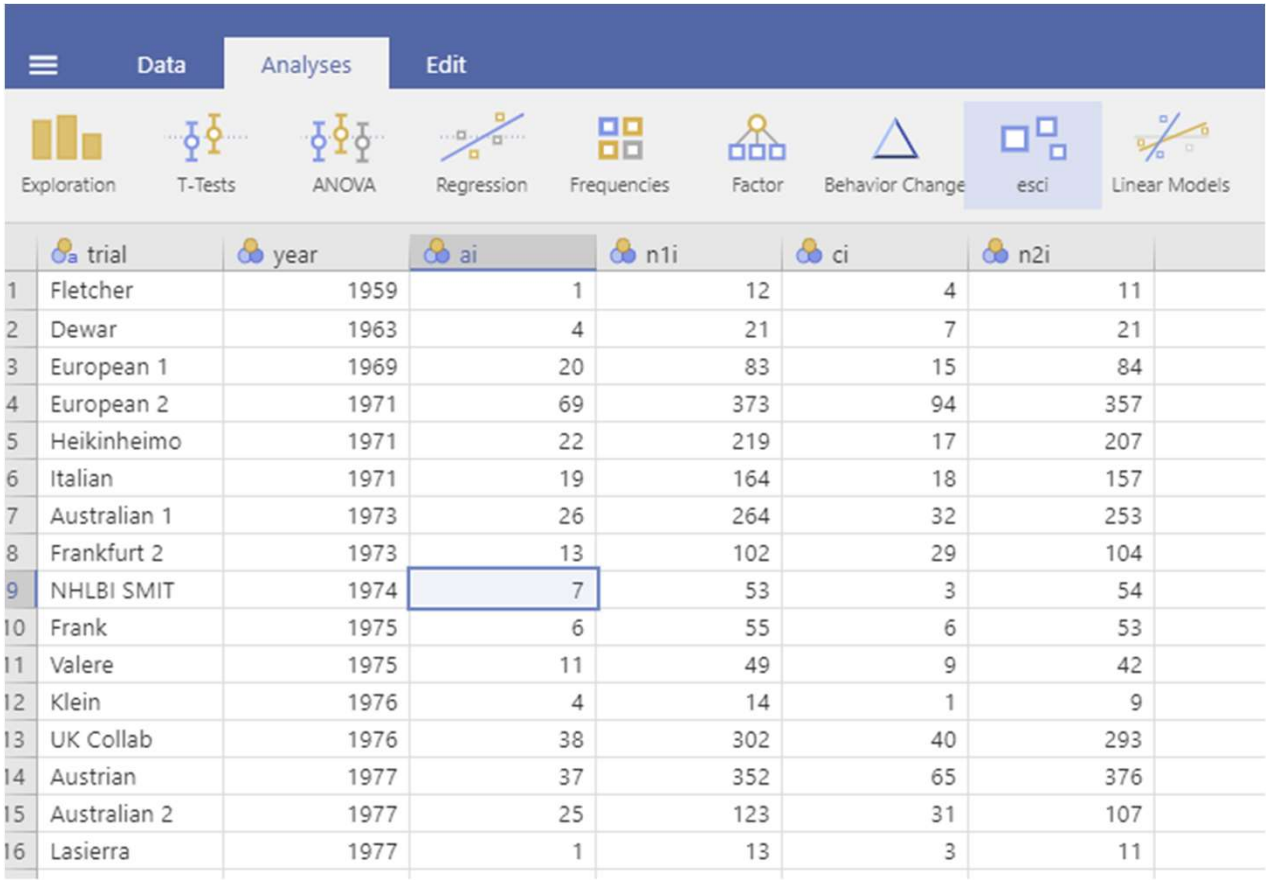
Yohanes Budiarto, Avin Fadilla Helmi (2021)
Shame and Self-Esteem: A Meta-Analysis

Normand 1992



A	study	source	n1i	m1i	sd1i	n2i	m2i	sd2i
1	1	Edinburgh	155	55	47	156	75	64
2	2	Orpington-M...	31	27	7	32	29	4
3	3	Orpington-M...	75	64	17	71	119	29
4	4	Orpington-Se...	18	66	20	18	137	48
5	5	Montreal-Ho...	8	14	8	13	18	11
6	6	Montreal-Tra...	57	19	7	52	18	4
7	7	Newcastle	34	52	45	33	41	34
8	8	Umea	110	21	16	183	31	27
9	9	Uppsala	60	30	27	52	23	20

Lau 1992



	trial	year	ai	n1i	ci	n2i
1	Fletcher	1959	1	12	4	11
2	Dewar	1963	4	21	7	21
3	European 1	1969	20	83	15	84
4	European 2	1971	69	373	94	357
5	Heikinheimo	1971	22	219	17	207
6	Italian	1971	19	164	18	157
7	Australian 1	1973	26	264	32	253
8	Frankfurt 2	1973	13	102	29	104
9	NHLBI SMIT	1974	7	53	3	54
10	Frank	1975	6	55	6	53
11	Valere	1975	11	49	9	42
12	Klein	1976	4	14	1	9
13	UK Collab	1976	38	302	40	293
14	Austrian	1977	37	352	65	376
15	Australian 2	1977	25	123	31	107
16	Lasierra	1977	1	13	3	11

Contoh Studi Korelasional

Input

Proses

	study	correl	n
1	Fonda	0.50	40
2	Newman	0.60	90
3	Grant	0.40	25
4	Granger	0.20	400
5	Milland	0.70	60
6	Finch	0.45	50

Effect Sizes

	study	correl	n	yi	vi
1	Fonda	0.50	40	0.5493	0.0270
2	Newman	0.60	90	0.6931	0.0115
3	Grant	0.40	25	0.4236	0.0455
4	Granger	0.20	400	0.2027	0.0025
5	Milland	0.70	60	0.8673	0.0175
6	Finch	0.45	50	0.4847	0.0213

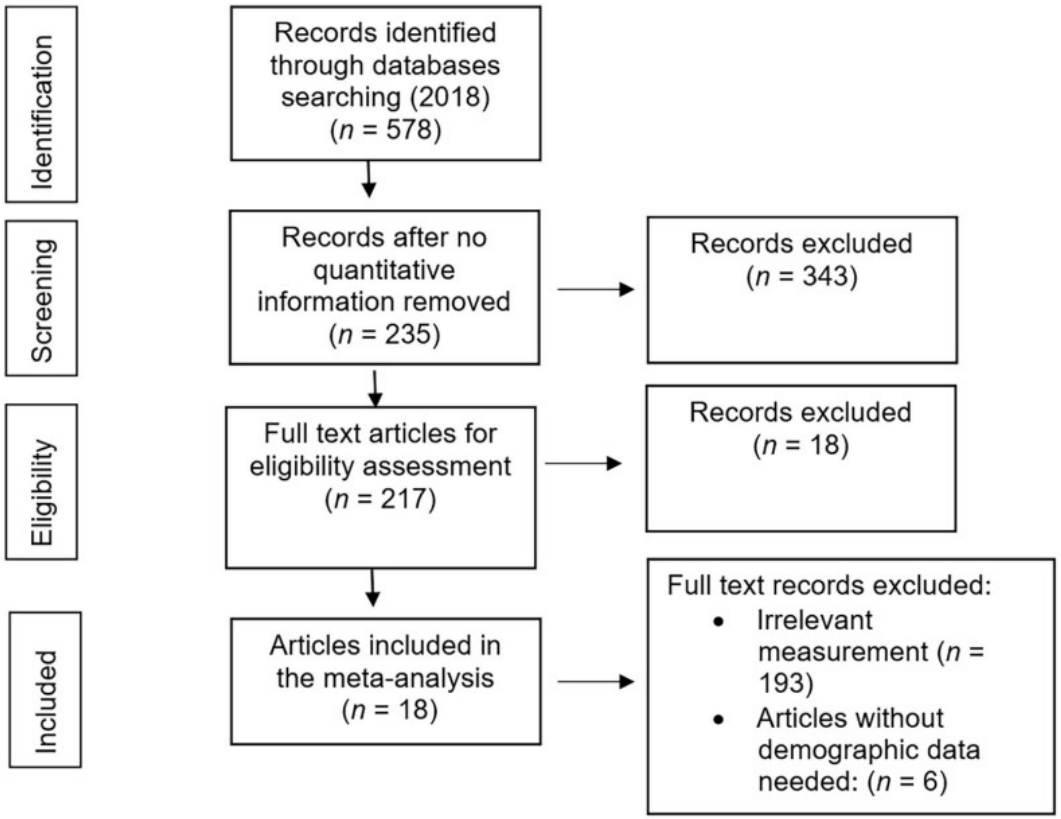
Bagian #1

Statistik-Statistik dalam

META ANALYSIS

KELUARAN ANALISIS

Prisma Diagram


Identification
Screening
Eligibility
Included
Records identified through databases searching (2018) (n = 578)
Records after no quantitative information removed (n = 235)
Records excluded (n = 343)
Full text articles for eligibility assessment (n = 217)
Records excluded (n = 18)
Articles included in the meta-analysis (n = 18)
Full text records excluded:
Irrelevant measurement (n = 193)
Articles without demographic data needed: (n = 6)

Keluaran

Table 5

The Orwin's Fail-Safe N Test

Orwin's fail-safe *N*	**Criterion**
Fisher's *Z* in observed studies	−0.621
The criterion for a trivial Fisher's *Z*	−0.600
Mean Fisher's *Z* in missing studies	0.000
Number of missing studies to bring Fisher's *Z* over −0.650	1.000

Table 6

Rank Correlation Test for Funnel Plot Asymmetry

Kendall's Tau	***Z* for Tau**	***p***
−.03	0.15	.439 (one-tailed) .879 (two-tailed)

Keluaran

Hasil Utama

Table 7

Duval and Tweedie's Trim and Fill

Value	Studies trimmed	Point estimate	*LL*	*UL*	*Q*
Observed values		−0.643	−0.784	−0.502	346.444
Adjusted values	7	−0.812	−0.962	−0.663	741.736

JASP

Fixed and Random Effects ▼

	Q	df	p
Omnibus test of Model Coefficients	16.045	1	< .001
Test of Residual Heterogeneity	163.194	12	< .001

Note. *p*-values are approximate.

Coefficients

	Estimate	Standard Error	z	p
intercept	−0.745	0.186	−4.006	< .001

Note. Wald test.

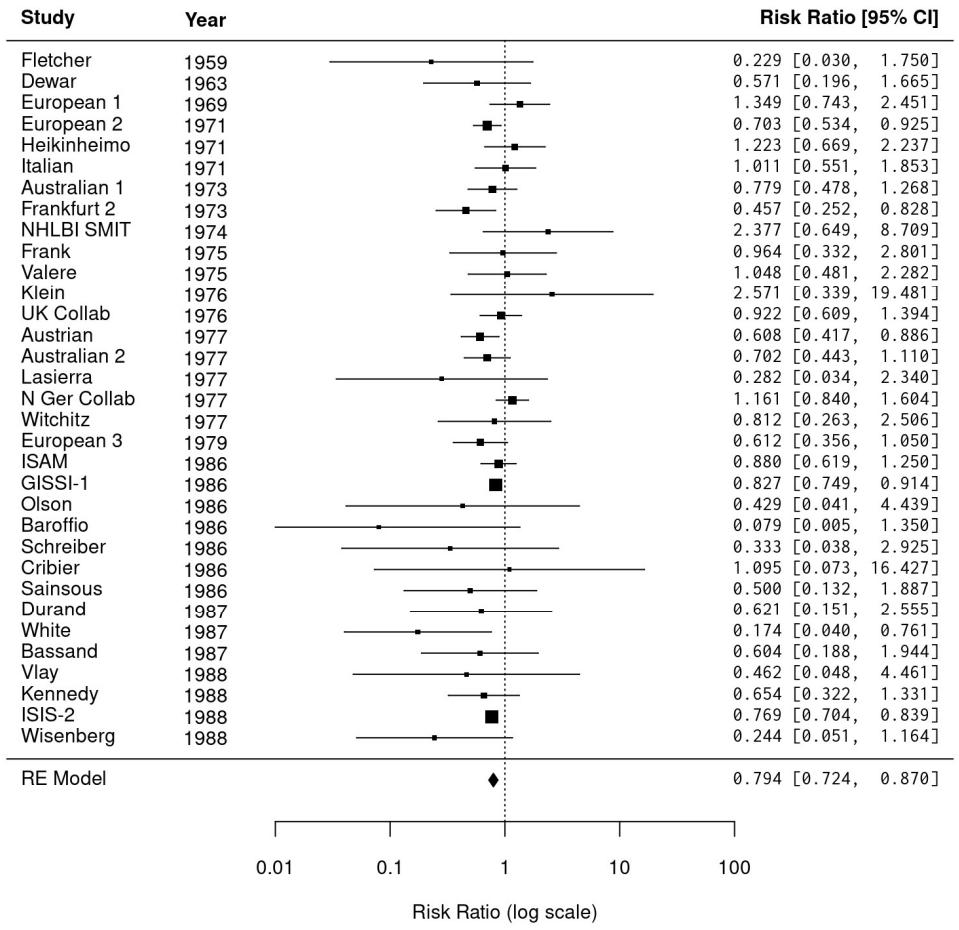
Jamovi

Random-Effects Model (k = 9)

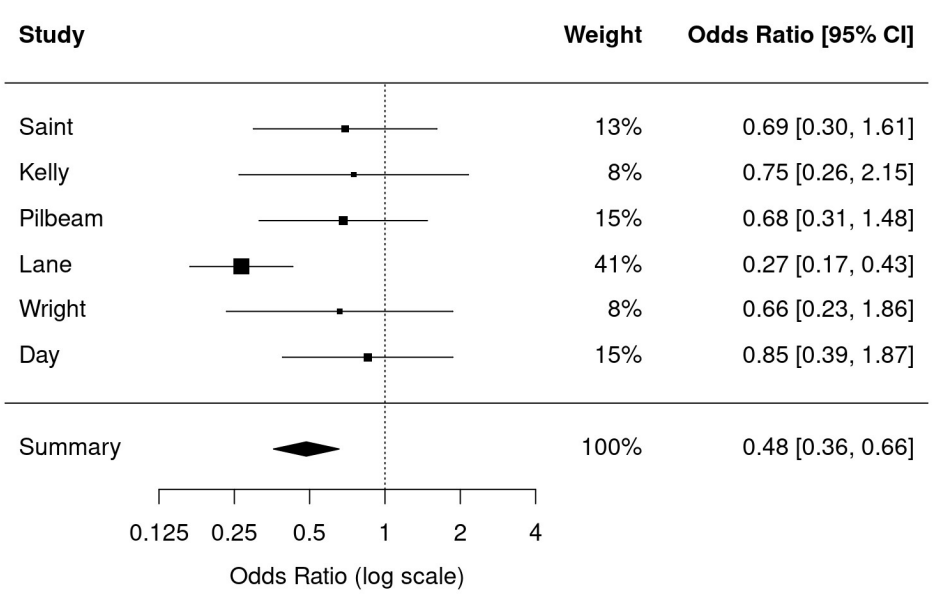
	Estimate	se	Z	p	CI Lower Bound	CI Upper Bound
Intercept	-0.537	0.309	-1.74	0.082	-1.142	0.068
	.	.	.	.	.	.

Note. Tau² Estimator: Restricted Maximum-Likelihood

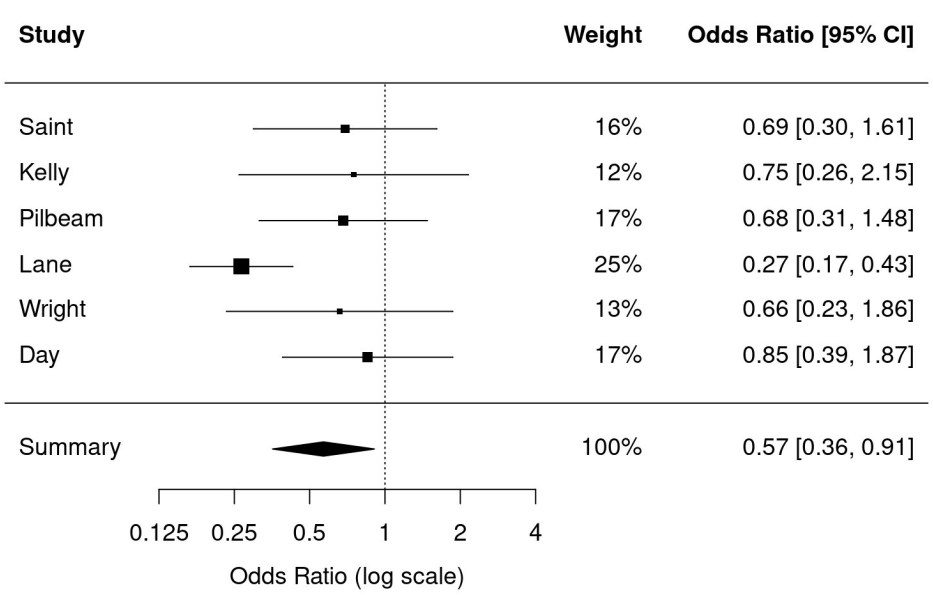
Forest Plot


Study
Year
Risk Ratio [95% CI]
Fletcher 1959 0.229 [0.030, 1.750]
Dewar 1963 0.571 [0.196, 1.665]
European 1 1969 1.349 [0.743, 2.451]
European 2 1971 0.703 [0.534, 0.925]
Heikinheimo 1971 1.223 [0.669, 2.237]
Italian 1971 1.011 [0.551, 1.853]
Australian 1 1973 0.779 [0.478, 1.268]
Frankfurt 2 1973 0.457 [0.252, 0.828]
NHLBI SMIT 1974 2.377 [0.649, 8.709]
Frank 1975 0.964 [0.332, 2.801]
Valere 1975 1.048 [0.481, 2.282]
Klein 1976 2.571 [0.339, 19.481]
UK Collab 1976 0.922 [0.609, 1.394]
Austrian 1977 0.608 [0.417, 0.886]
Australian 2 1977 0.702 [0.443, 1.110]
Lasierra 1977 0.282 [0.034, 2.340]
N Ger Collab 1977 1.161 [0.840, 1.604]
Witchitz 1977 0.812 [0.263, 2.506]
European 3 1979 0.612 [0.356, 1.050]
ISAM 1986 0.880 [0.619, 1.250]
GISSI-1 1986 0.827 [0.749, 0.914]
Olson 1986 0.429 [0.041, 4.439]
Baroffio 1986 0.079 [0.005, 1.350]
Schreiber 1986 0.333 [0.038, 2.925]
Cribier 1986 1.095 [0.073, 16.427]
Sainsous 1986 0.500 [0.132, 1.887]
Durand 1987 0.621 [0.151, 2.555]
White 1987 0.174 [0.040, 0.761]
Bassand 1987 0.604 [0.188, 1.944]
Vlay 1988 0.462 [0.048, 4.461]
Kennedy 1988 0.654 [0.322, 1.331]
ISIS-2 1988 0.769 [0.704, 0.839]
Wisenberg 1988 0.244 [0.051, 1.164]
RE Model 0.794 [0.724, 0.870]
0.01
0.1
1
10
100
Risk Ratio (log scale)

fixed-effects model analysis



random-effects model analysis



UKURAN EFEK (EFFECT SIZE)

- Effect Sizes Based on Means
- Effect Sizes Based on Binary Data

- Effect Sizes Based on Correlations
  - Transformasi r-to-z

Rerata

Formula

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Eror Standar

$$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$$

N
Mean
Standard deviation

Representasi Rerata

- M = Raw means
- SMCC = standardized mean change
- SMCR = standardized mean change using raw
- ROMC = log transformed ratio of means

Proporsi (0,1)

$$p = \frac{k}{n}$$

$$SE_p = \sqrt{\frac{p(1-p)}{n}}$$

N
Mean
Standard deviation

k = individu, n = ukuran sampel

Ketika p sangat rendah atau sangat tinggi, distribusi sampling akan kurang mendekati distribusi. Distribusi data cenderung miring ke kanan atau ke kiri karena tidak mungkin sampel acak memiliki proporsi yang dihitung di luar rentang 0-1. Untuk menghindari hal ini, proporsi ditransformasi menjadi skala/metrik logit. Transformasi logit pertama-tama melibatkan penghitungan odds

$$p_{\text{logit}} = \log_e \left(\frac{p}{1-p} \right)$$

$$SE_{p_{\text{logit}}} = \sqrt{\frac{1}{np} + \frac{1}{n(1-p)}}$$

k = individu, n = ukuran sampel

Korelasi

Formula

$$r_{xy} = \frac{\sigma^2_{xy}}{\sigma_x \sigma_y}$$

sigma-x = deviasi standar

Eror Standar

$$SE_{r_{xy}} = \frac{1 - r^2_{xy}}{\sqrt{n-2}}$$

n = ukuran sampel

Cohen's (1988)

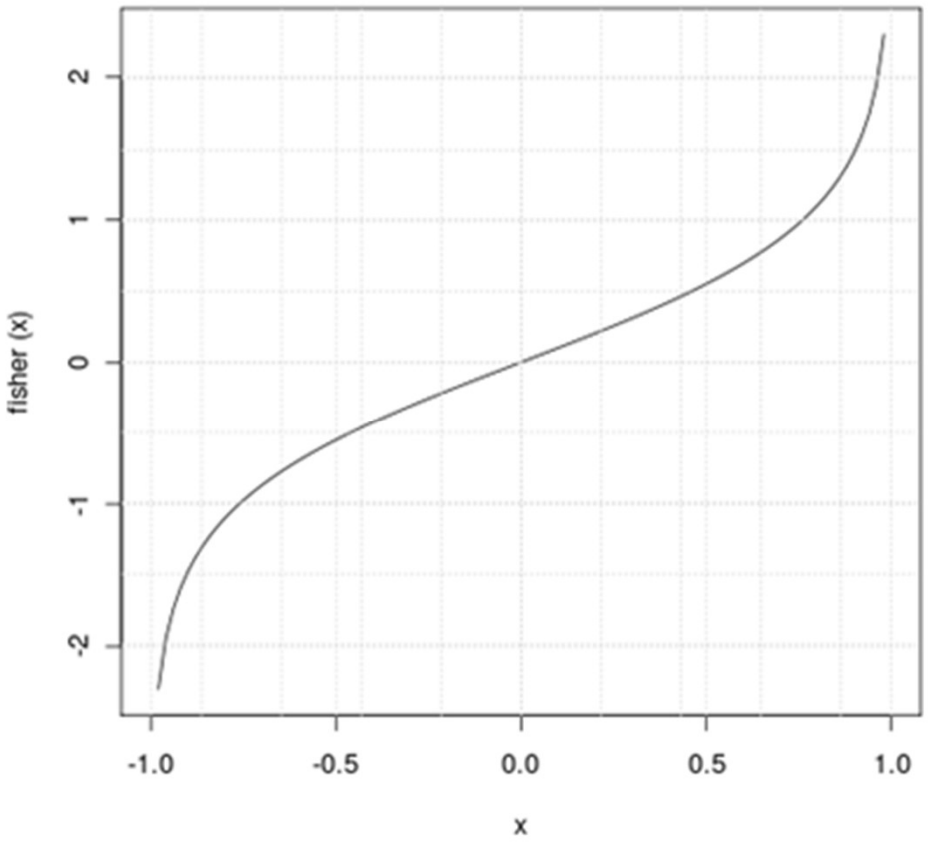
- $r \approx 0.10$: small effect.
- $r \approx 0.30$: moderate effect.
- $r \approx 0.50$: large effect.

Fisher Transformation

Seperti halnya proporsi, harga korelasi terbatas sehingga dapat menimbulkan bias ketika kita memperkirakan eror standar untuk studi dengan ukuran sampel yang kecil.

Dalam meta-analisis, korelasi biasanya diubah menjadi Z Fisher. Seperti halnya transformasi logit, prosedurnya juga memerlukan penggunaan fungsi logaritma natural untuk menghilangkan batasan jangkauan dan memastikan bahwa distribusi sampling mendekati normal.

$$z = 0.5 \log_e \left(\frac{1+r}{1-r} \right)$$



Fisher Transformation

Formula

$$z = 0.5 \log_e \left(\frac{1+r}{1-r} \right)$$

```
z=0.5*log((1+r)/(1-r))
```

Eror Standar

$$SE_z = \frac{1}{\sqrt{n-3}}$$

Perbandingan Rerata (Between)

Formula

$$\mathrm{MD}_{\text{between}} = \bar{x}_1 - \bar{x}_2$$

$$s_{\text{pooled}} = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{(n_1 - 1) + (n_2 - 1)}}$$

Eror Standar

$$SE_{\mathrm{MD}_{\text{between}}} = s_{\text{pooled}} \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

Perbandingan Rerata (Within)

Formula

$$\mathrm{MD}_{\text{within}} = \bar{x}_{t_2} - \bar{x}_{t_1}$$

$$\mathrm{SMD}_{\text{within}} = \frac{\bar{x}_{t_2} - \bar{x}_{t_1}}{\left(\frac{\sqrt{(s_{t_1}^2 + s_{t_2}^2)/2}}{\sqrt{2(1 - r_{t_1 t_2})}} \right)}$$

Eror Standar

$$SE_{\mathrm{MD}_{\text{within}}} = \sqrt{\frac{s_{t_1}^2 + s_{t_2}^2 - (2 r_{t_1 t_2} s_{t_1} s_{t_2})}{n}}$$

$$SE_{\mathrm{SMD}_{\text{within}}} = \sqrt{\frac{2(1 - r_{t_1 t_2})}{n} + \frac{\mathrm{SMD}_{\text{within}}^2}{2n}}$$

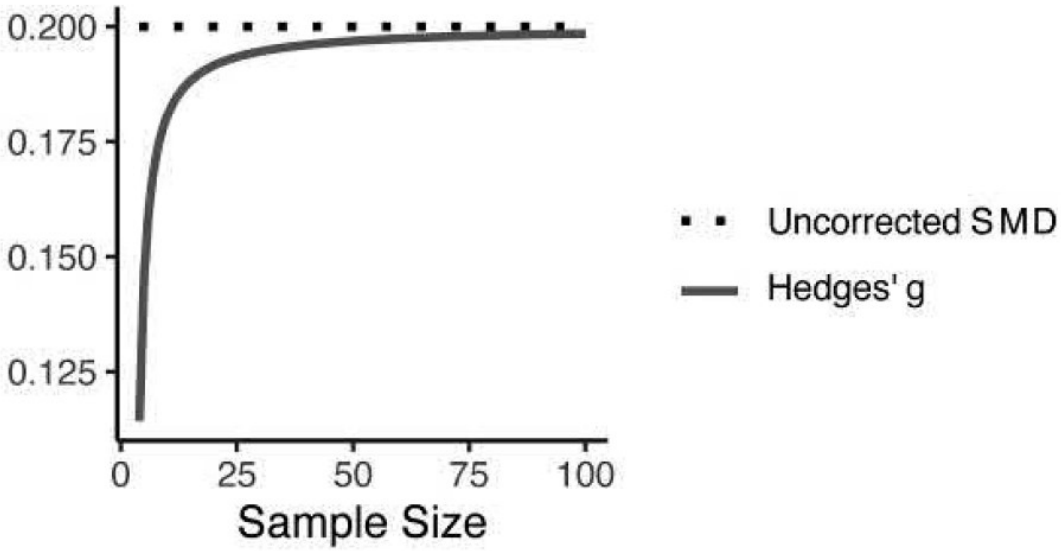
KOREKSI TERHADAP EFFECT SIZE

Small Sample Bias

Hedges g

$$g = \text{SMD} \times (1 - \frac{3}{4n - 9})$$

n = ukuran sampel
SMD = SD of mean differences



Koreksi terhadap Atenuasi

Formula

$$r_{xy_c} = \frac{r_{xy}}{\sqrt{r_{xx}}}$$

y = kategorikal
X = kontinyu

$$r_{xy_c} = \frac{r_{xy}}{\sqrt{r_{xx}}\sqrt{r_{yy}}}$$

y = kontinyu
X = kontinyu

Eror Standar

$$SE_c = \frac{SE}{\sqrt{r_{xx}}}$$

$$SE_c = \frac{SE}{\sqrt{r_{xx}}\sqrt{r_{yy}}}$$

Range Restriction

$$U = \frac{s_{\text{unrestricted}}}{s_{\text{restricted}}}$$

$$r_{xy_c} = \frac{U \times r_{xy}}{\sqrt{(U^2 - 1)r_{xy}^2 + 1}}$$

$$\text{SMD}_c = \frac{U \times \text{SMD}}{\sqrt{(U^2 - 1)\text{SMD}^2 + 1}}$$

FIXED VS RANDOM EFFECT

Tujuan dari analisis meta adalah mendapatkan ukuran efek dari setiap studi

1. Fixed-effect model | satu efek murni berlaku

2. Random-effects model | ukuran efek murni berlaku

   True effect size (Θ) – effect pada populasi
   Ukuran efek yang dilakukan pada studi jika $n = \infty$
   Observed effect (Y) – ukuran efek yang terobservasi

FIXED-EFFECT MODEL	RANDOM-EFFECTS MODEL
-one true effect	-true effect varies
-differences b/w studies due to sampling error only	-differences b/w studies more than sampling error
-large studies more influential in ES estimation	-weight between all studies is more balanced
-account for within study uncertainty	-account for within study AND between study uncertainty
-summary effect=common effect	-summary effect=mean effect
-null hypothesis=0 effect in every study	-null hypothesis=0 mean effect
-summary effect limited to identified population	-summary effect more generalizable

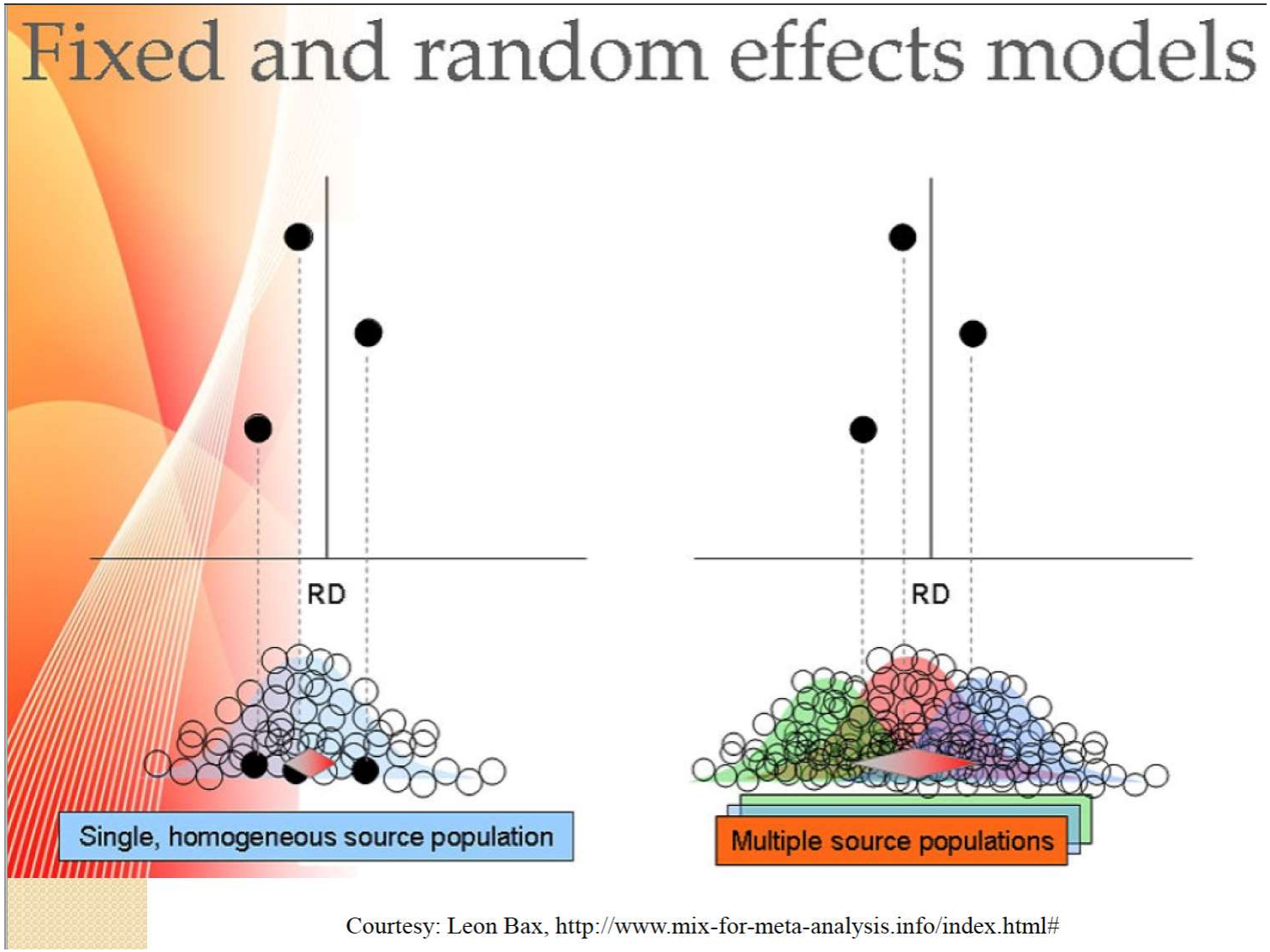
Fixed-effect model

- Semua faktor dapat mempengaruhi ES, sama untuk semua studi
  - True ES sama
  - Hanya bervariasi berdasarkan random sampling
  - Mengasumsikan jika $n = \infty$, → no sampling error

- Digunakan ketika
  1. Semua studi yang dilakukan identik
  2. Tujuannya untuk mendapatkan ES untuk populasi tertentu

Memerlukan estimasi terhadap ES murni berdasarkan efek tampak

Fixed and random effects models



Courtesy: Leon Bax, http://www.mix-for-meta-analysis.info/index.html#

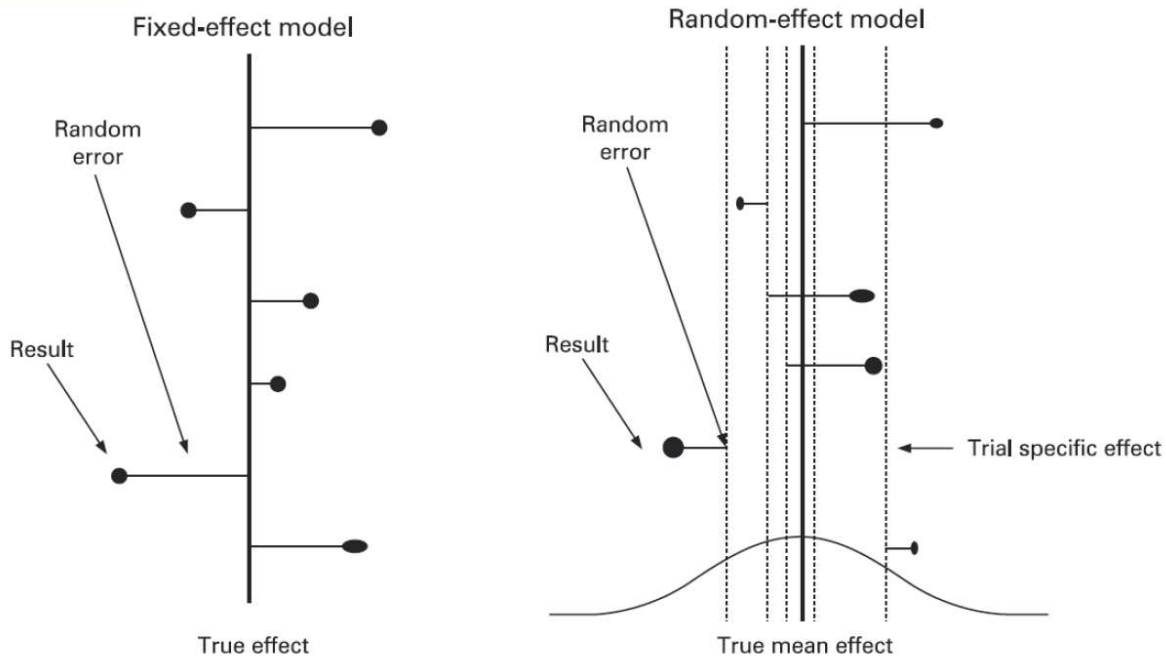


Figure 2. Graphical representation of the theoretical models used to combine data together.

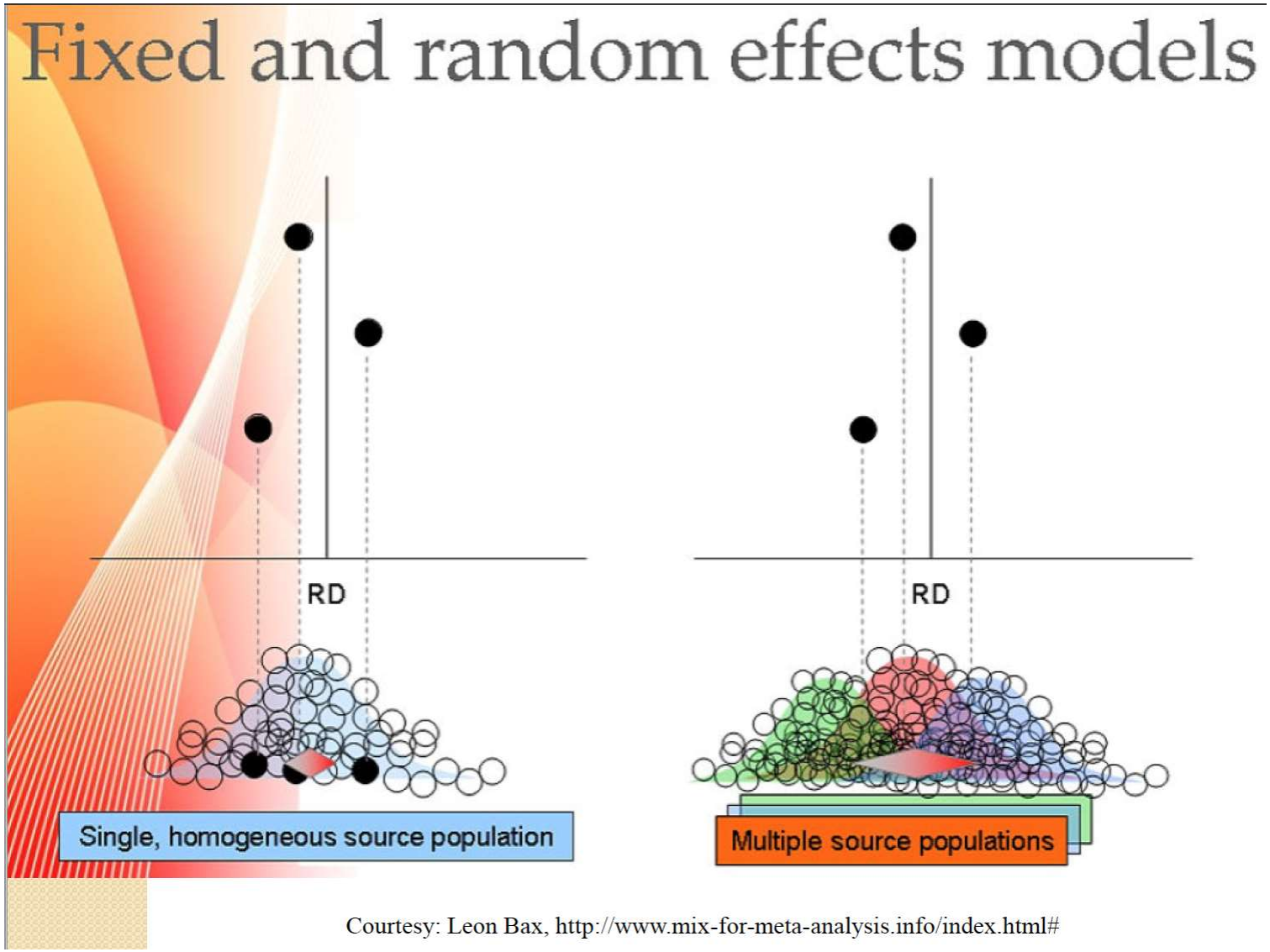
Fixed Effect Size: Prosedur

- Menetapkan efek tampak untuk memperkirakan efek populasi
  - Efek tampak adalah jumlah dari efek sebenarnya dan kesalahan pengambilan sampel
- Menetapkan bobot yang sesuai untuk semua studi (inverse varians studi)
- Mengitung rata-rata tertimbang dengan ES dan bobot yang diamati
- Menghitung semua ringkasan statistik (V, SE, CI, Z, p)

Random Effect Size

- Studi-studi yang dilibatkan tidak cukup mirip untuk mengasumsikan ES murni berlaku pada semua studi
- Mengasumsikan efek murni terdistribusi normal
- Tujuan-gunakan semua efek yang diamati untuk memperkirakan rata-rata dari semua ES yang sebenarnya

Fixed and random effects models



Courtesy: Leon Bax, http://www.mix-for-meta-analysis.info/index.html#

Fixed Effect Inverse Variance Weight

$$w_{FE} = \frac{1}{V_{ES}}$$

Random Effects Inverse Variance Weight

$$w_{RE} = \frac{1}{V_{ES} + \tau^2}$$

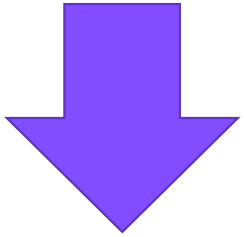
OUPUT ANALISIS

Statistik Utama

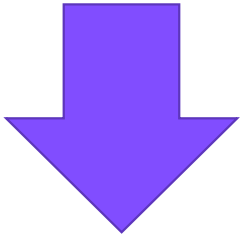
Random-Effects Model (k = 9)

	Estimate	se	Z	p	CI Lower Bound	CI Upper Bound
Intercept	-0.537	0.309	-1.74	0.082	-1.142	0.068
	.	.	.	.	.	.

Note. Tau^2 Estimator: Restricted Maximum-Likelihood



Keluaran dari Statistik Input



Uji Signifikansi Statistik

Statistik Heterogenitas

Heterogeneity Statistics

Tau	Tau²	I²	H²	R²	df	Q	p
0.889	0.7908 (SE= 0.4281)	95.49%	22.197	.	8.000	123.729	< .001

Statistik Q dan I

$$Q = \Sigma(w_i * (ES - Mean(ES))^2$$

$$I = 100\% * (Q-df/Q)$$

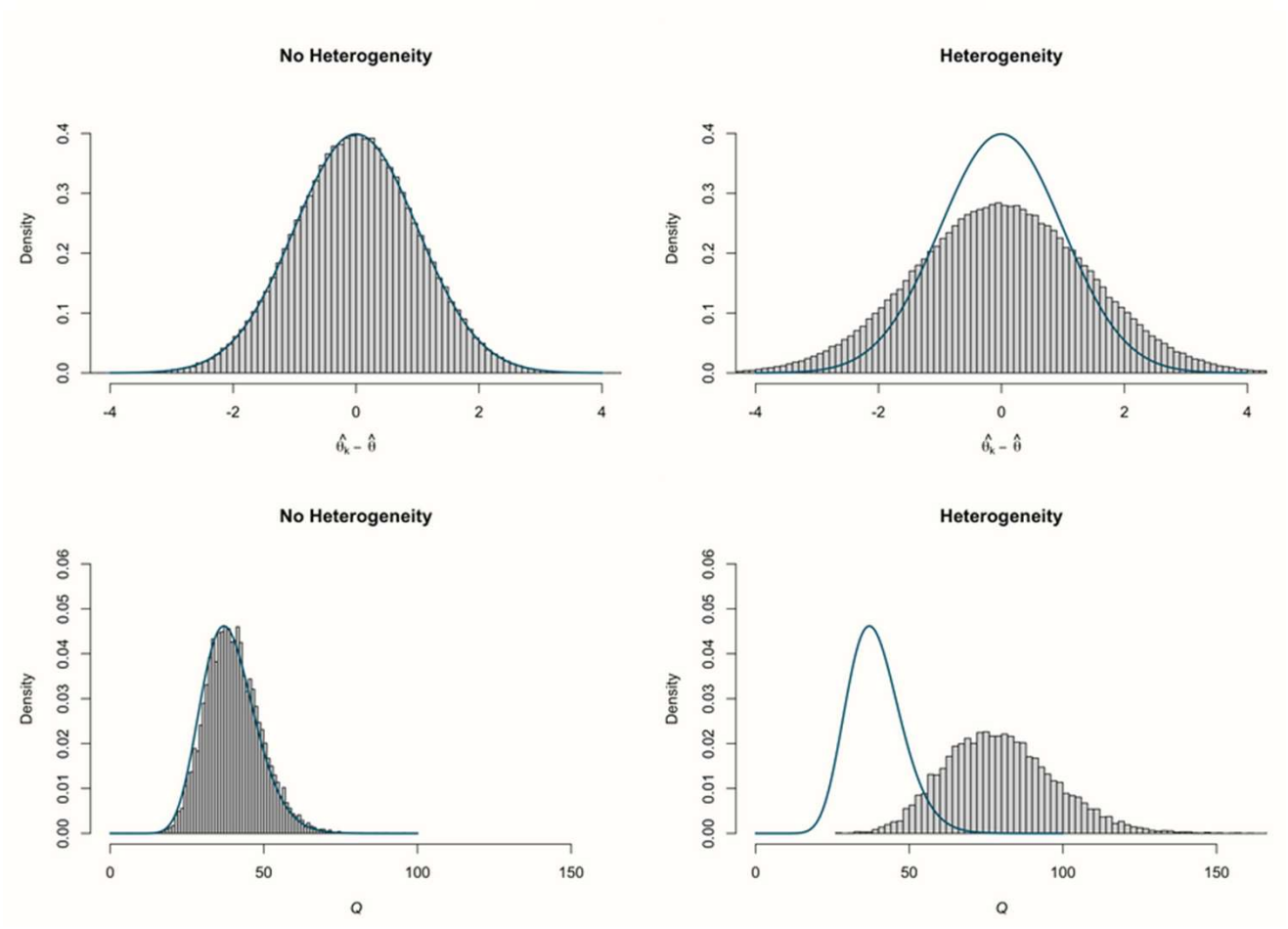
ES = effect size study
Mean(ES) = mean ES terbobot
w_i = bobot

Q=Cochran Statistik

Cohran's Q
Q is the weighted sum of squares on a standardized scale. It is reported with a P value with low P-values indicating presence of heterogeneity. This test however is known to have low power to detect heterogeneity and it is suggested to use a value of 0.10 as a cut-off for significance (Higgins et al., 2003). Conversely, Q has too much power as a test of heterogeneity if the number of studies is large.

I^2 statistic
I^2 is the percentage of observed total variation across studies that is due to real heterogeneity rather than chance. It is calculated as I^2 = 100% x (Q - df)/Q, where Q is Cochran's heterogeneity statistic and df the degrees of freedom. Negative values of I^2 are put equal to zero so that I^2 lies between 0% and 100%. A value of 0% indicates no observed heterogeneity, and larger values show increasing heterogeneity (Higgins et al., 2003).

Statistik Q


No Heterogeneity
Heterogeneity
Density
$\hat{\theta}_k - \hat{\theta}$
No Heterogeneity
Heterogeneity
Density
Q

Publication Bias

Hypothesized that the chance that a statistically significant result is published is higher than a statistically non-significant result. Hence, the combined effect size in the study might be larger than it is in reality.

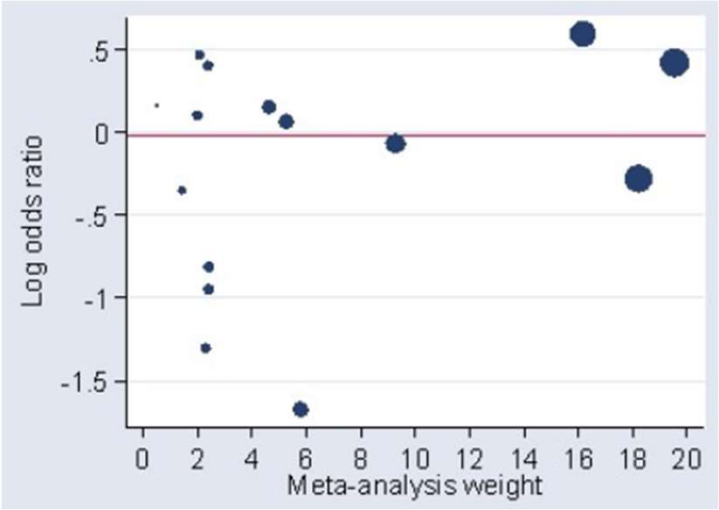
Publication Bias Assessment

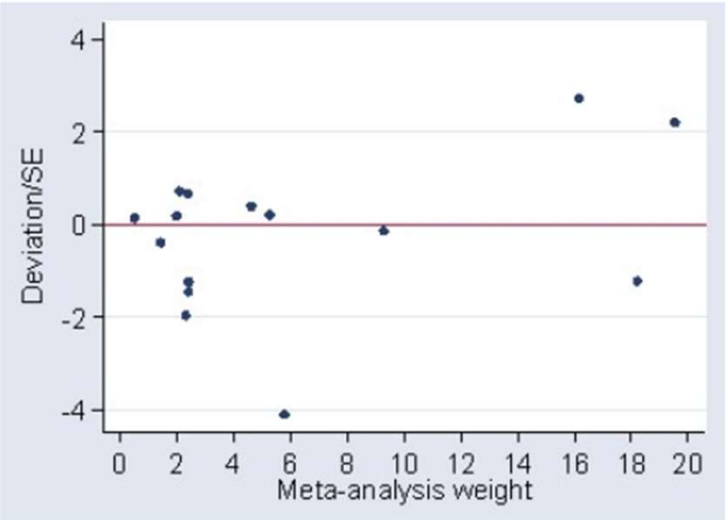
Test Name	value	p
Fail-Safe N	152.000	< .001
Begg and Mazumdar Rank Correlation	−0.278	0.358
Egger's Regression	−0.860	0.390
Trim and Fill Number of Studies	0.000	.

Note. Fail-safe N Calculation Using the Rosenthal Approach

Begg dan Egger test: Apakah setiap studi berkaitan dengan ukurannya?

Uji Statistik Begg





Kendall's tau-b = 0,09 (p > 0,050

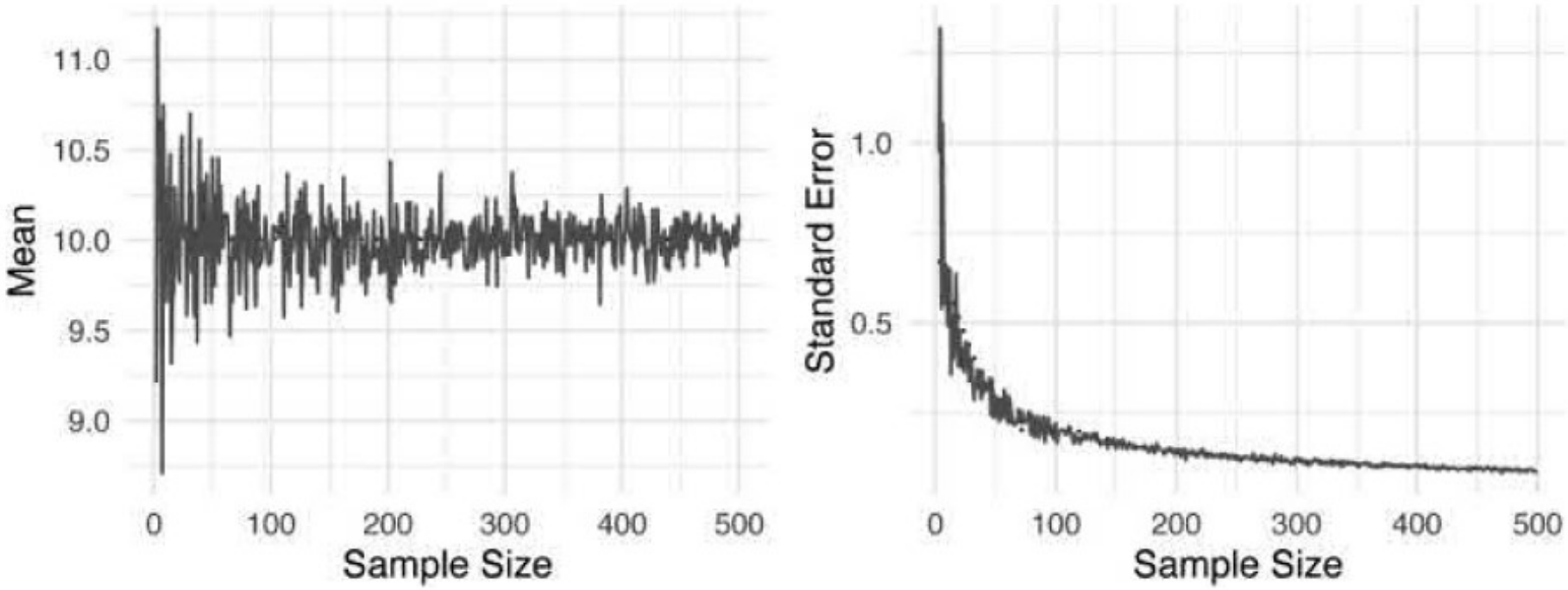


FIGURE 3.2: Sample mean and standard error as a function of sample size.

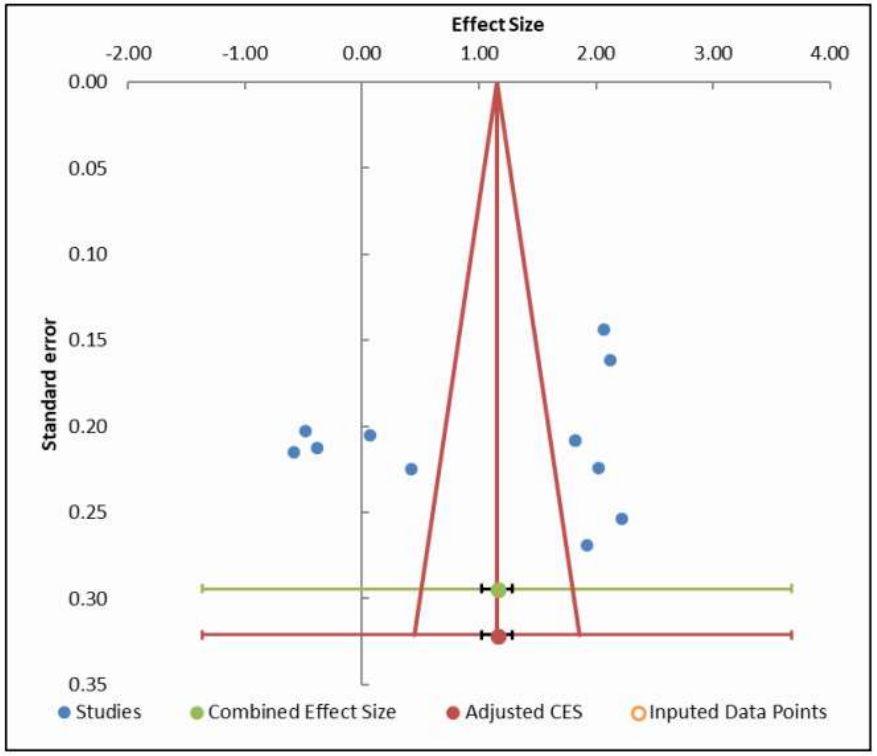
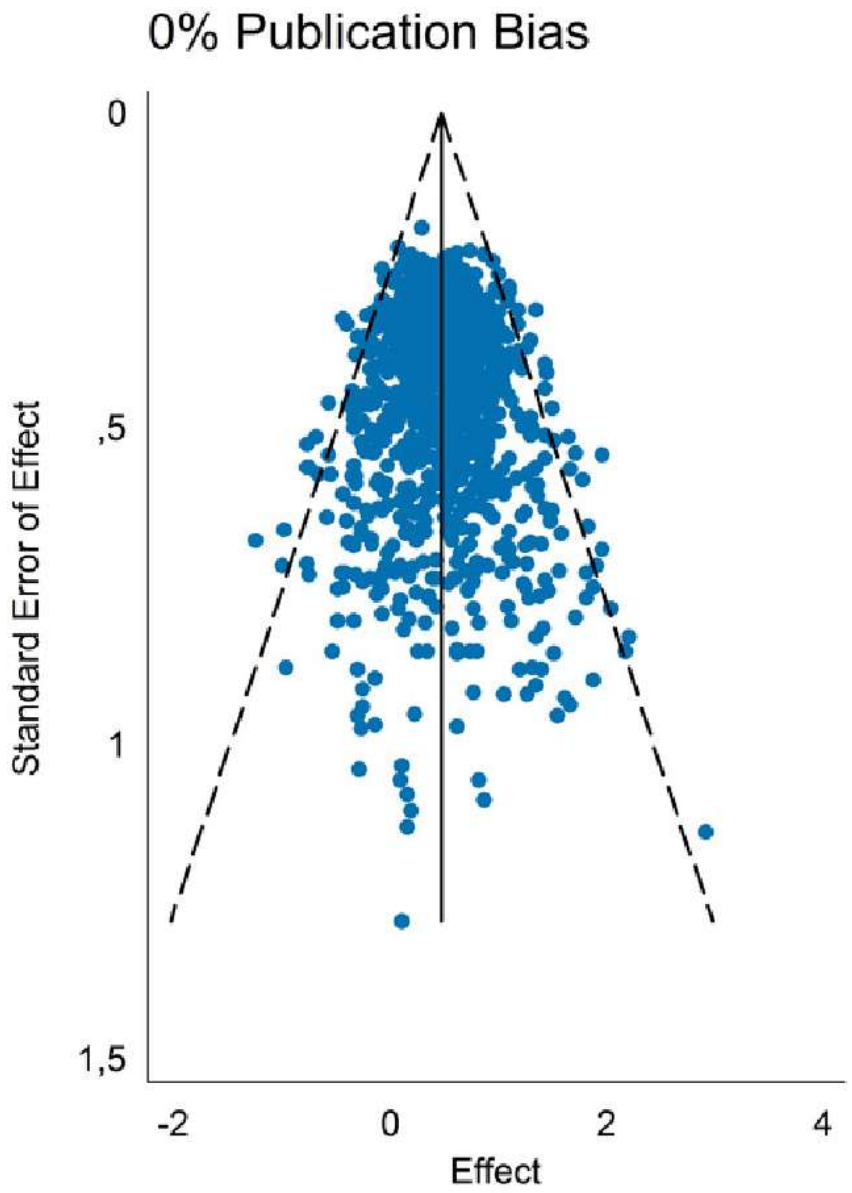
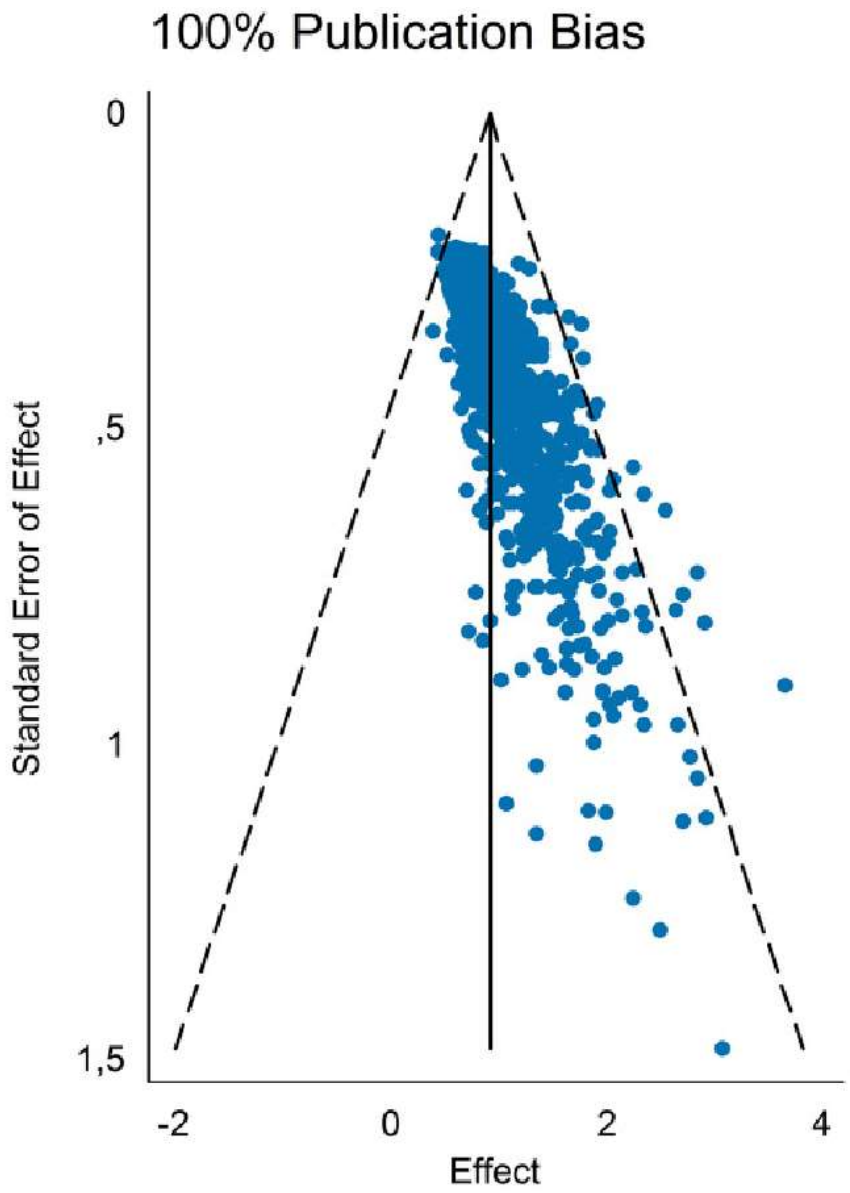


Figure 10: Example of a funnel plot

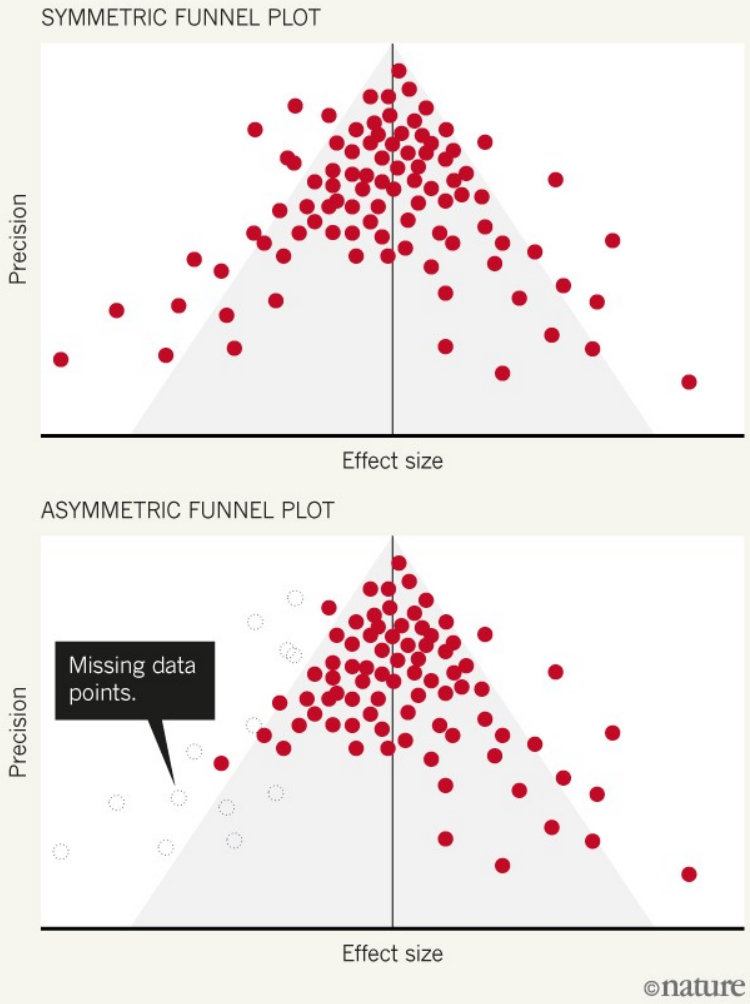
Diasumsikan bahwa ukuran efek yang diamati dengan presisi yang sama (= eror standar yang serupa) harus lebih atau kurang terdistribusi secara simetris di sekitar ukuran efek gabungan. Hipotesisnya adalah bahwa akan ada lebih banyak hasil yang jauh dari nol daripada lebih dekat ke nol. Ini tidak terjadi pada contoh. Karena tidak ada titik data yang dipotong (berdasarkan metode Trim-and-Fill), plot corong menunjukkan tidak ada asimetri dalam distribusi ukuran efek.

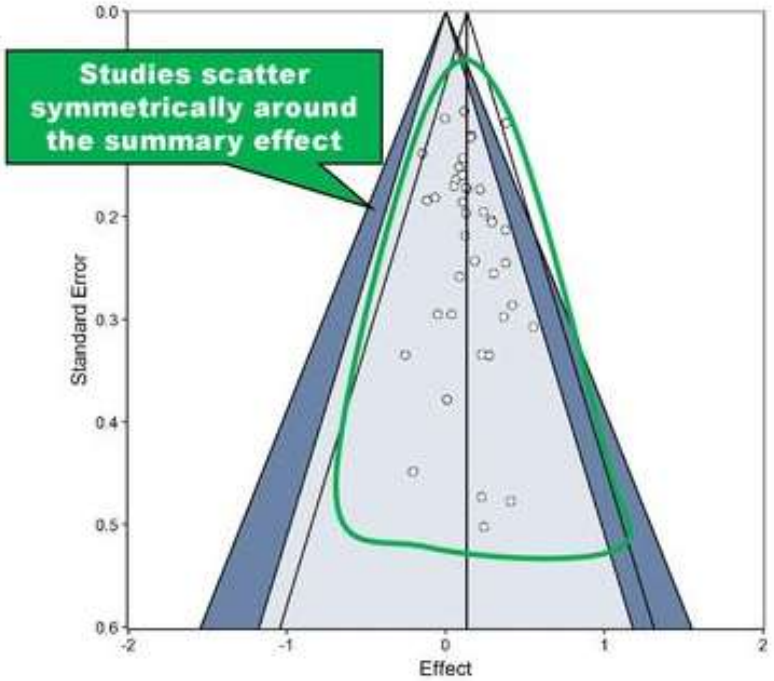

0% Publication Bias
Standard Error of Effect
0
,5
1
1,5
-2
0
2
4
Effect

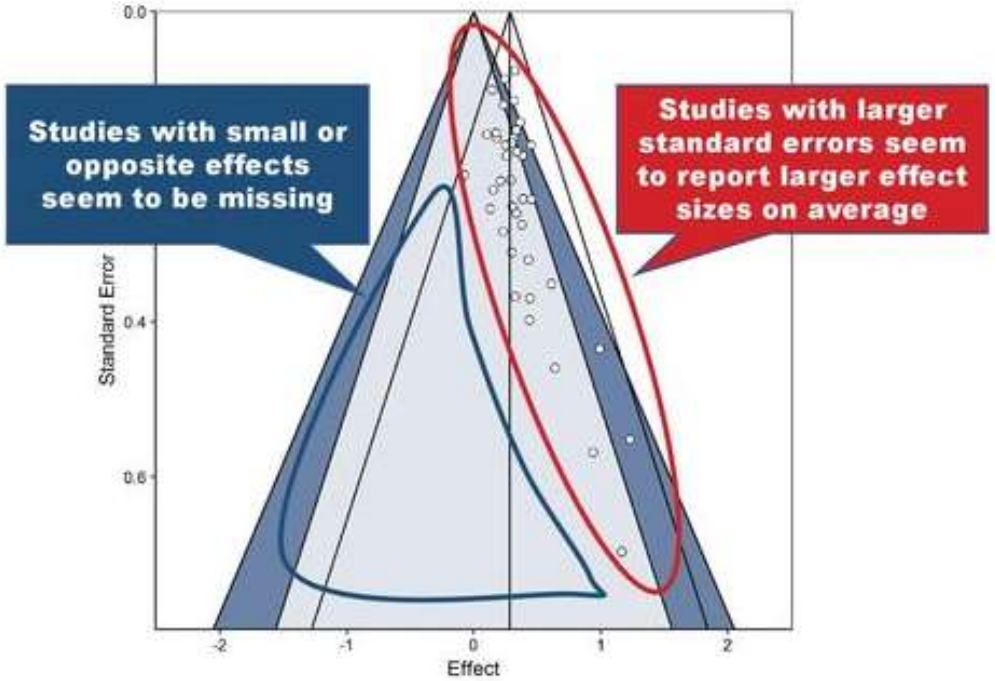

100% Publication Bias
Standard Error of Effect
0
,5
1
1,5
-2
0
2
4
Effect

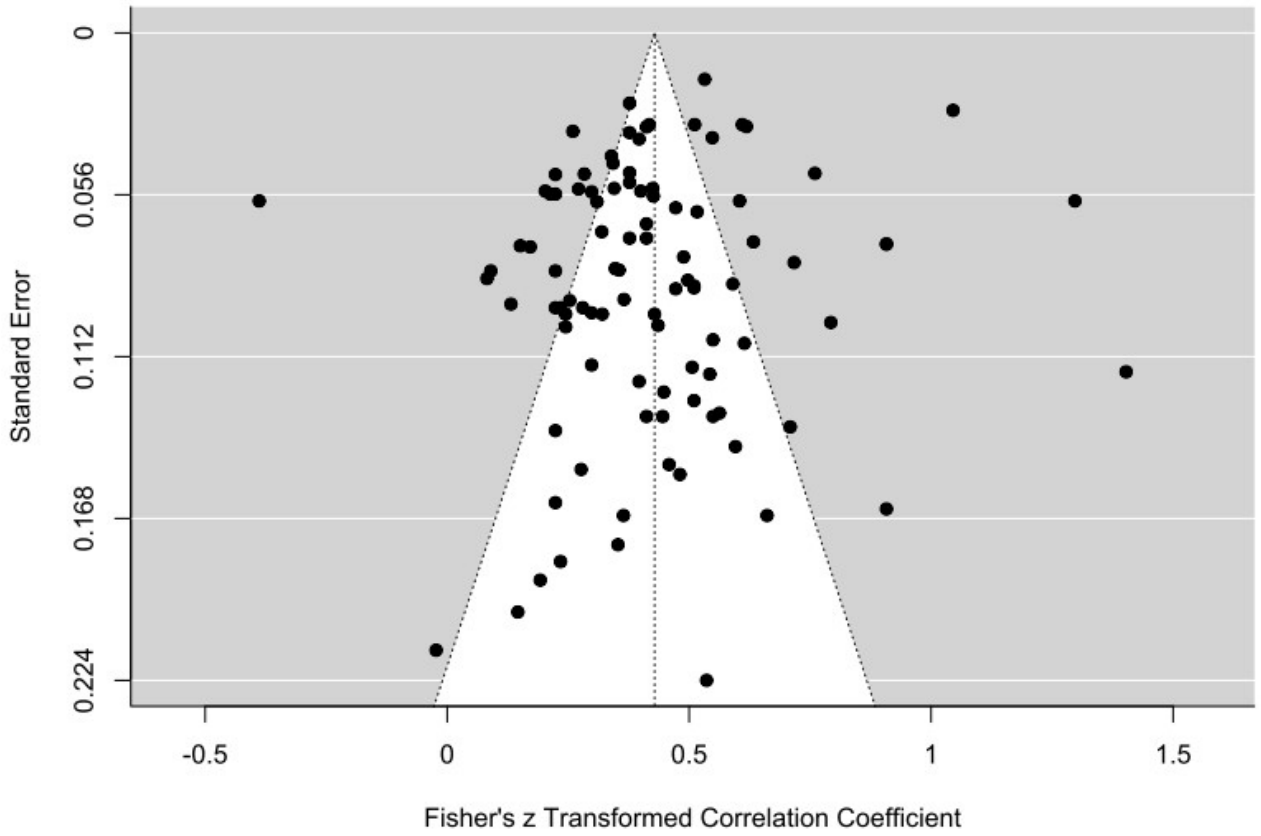
PLOTTING FOR PUBLICATION BIAS

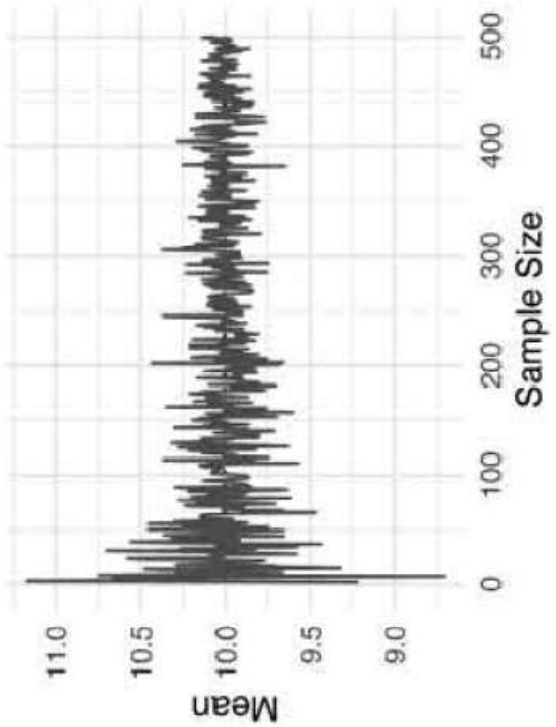
Funnel plots show the data from multiple experiments. In some – but not all – cases, a wildly asymmetric shape can indicate that some negative results are missing from the literature.




Studies scatter symmetrically around the summary effect
Standard Error
0.0
0.2
0.3
0.4
0.5
0.6
-2
-1
0
1
2
Effect


Studies with small or opposite effects seem to be missing
Studies with larger standard errors seem to report larger effect sizes on average
Standard Error
0.0
0.4
0.6
-2
-1
0
1
2
Effect


Standard Error
0
0.056
0.112
0.168
0.224
-0.5
0
0.5
1
1.5
Fisher's z Transformed Correlation Coefficient


Sample Size
0
100
200
300
400
500
Mean
11.0
10.5
10.0
9.5
9.0

Statistik tau (T)

T^2 dan Tau adalah ukuran dispersi ukuran efek murni antara studi dalam hal skala ukuran efek. T^2 adalah perkiraan varians dari ukuran efek yang sebenarnya.

T2 tidak langsung dipakai sebagai ukuran heterogenitas tetapi digunakan untuk keperluan sebagai berikut

- Digunakan untuk menghitung Tahu
- Digunakan untuk memberikan bobot pada studi dalam meta-analisis di bawah model efek-acak. Tau adalah perkiraan deviasi standar dari distribusi ukuran efek sebenarnya, dengan asumsi bahwa ukuran efek sebenarnya ini terdistribusi secara normal. Tau digunakan untuk menghitung interval prediksi.

- Sejauh mana ukuran efek sebenarnya bervariasi dalam meta-analisis disebut heterogenitas antar-studi.
- Model efek acak (random effect model) mengasumsikan bahwa heterogenitas antar studi menyebabkan ukuran efek sebenarnya dari studi berbeda-beda.

- Masalah ini diatasi dengan statistik τ^2, yang mengkuantifikasi varians ini dalam efek murni. Statistik ini memungkinkan kita untuk menghitung efek gabungan (pooled effect), yang didefinisikan sebagai rata-rata dari distribusi ukuran efek murni.

Tes Q Cochran

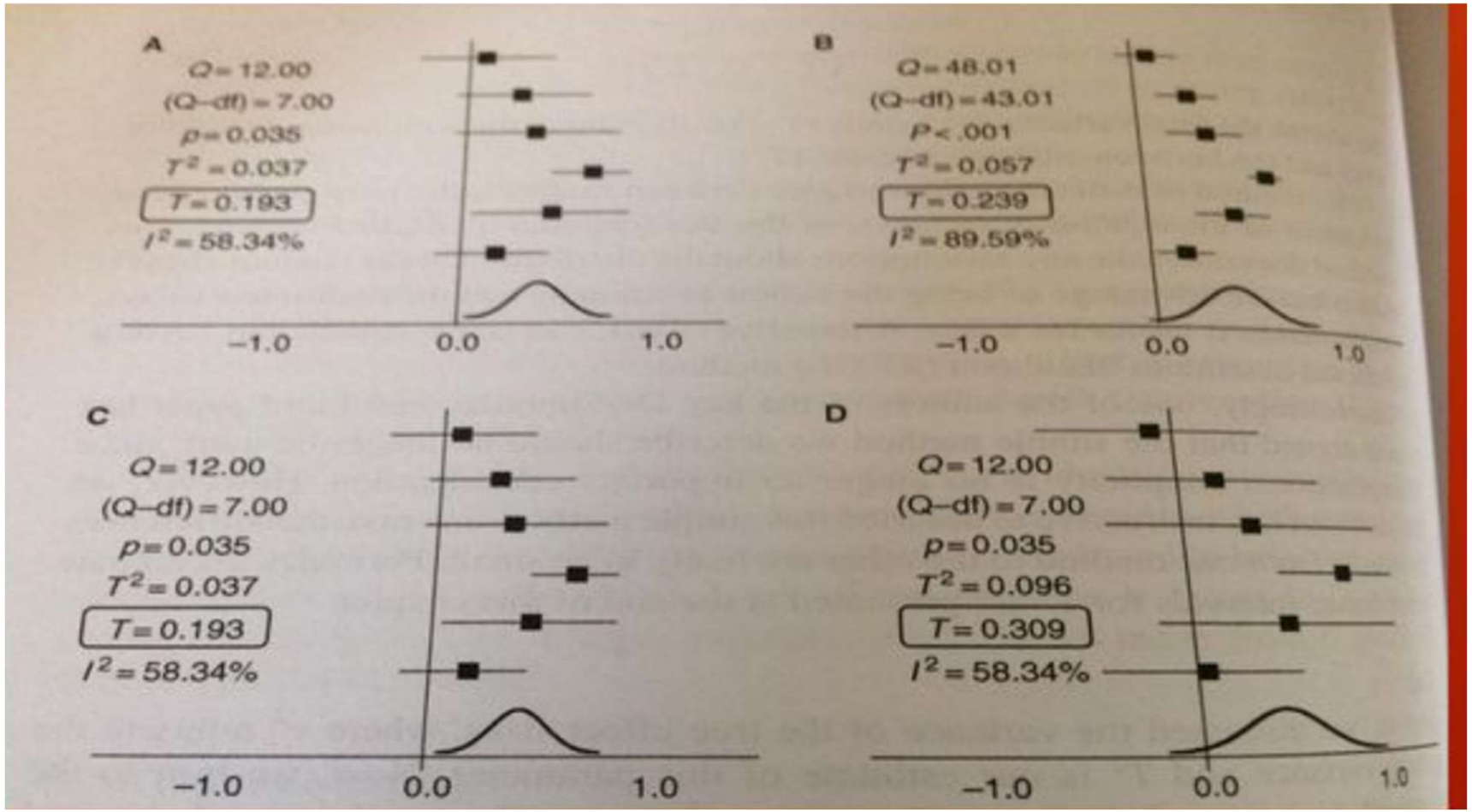
- Uji Q adalah ekstensi dari uji McNemar untuk menguji perbedaan antara tiga atau lebih rangkaian frekuensi atau proporsi yang cocok.

- Bertujuan untuk menguji heterogenitas dalam riset meta-analisis. Dengan menggunakan distribusi kai-kuadrat, uji ini menghasilkan informasi mengenai apakah variasi antar statistik pada unit-unit analisis itu setara.

Tes Q Cochran

- Hipotesis nol yang mendasari mengasumsikan bahwa efek perlakuan murni yang di seluruh studi dan variasinya yang disebabkan oleh kebetulan adalah sama.

- Keterbatasan uji Q Cochran adalah bahwa tes tersebut mungkin kurang memiliki daya ketika beberapa penelitian telah dimasukkan atau ketika tingkat kejadiannya rendah. Oleh karena itu, sering direkomendasikan untuk mengadopsi nilai P yang lebih tinggi (daripada 0,05) sebagai ambang batas signifikansi statistik saat menggunakan uji Cochran's Q untuk menentukan heterogenitas statistik.


A
Q = 12.00
(Q–df) = 7.00
p = 0.035
T² = 0.037
T = 0.193
I² = 58.34%
−1.0
0.0
1.0
B
Q = 48.01
(Q–df) = 43.01
P < .001
T² = 0.057
T = 0.239
I² = 89.59%
−1.0
0.0
1.0
C
Q = 12.00
(Q–df) = 7.00
p = 0.035
T² = 0.037
T = 0.193
I² = 58.34%
−1.0
0.0
1.0
D
Q = 12.00
(Q–df) = 7.00
p = 0.035
T² = 0.096
T = 0.309
I² = 58.34%
−1.0
0.0
1.0

Indeks Ketepatan Model

Model Fit Statistics and Information Criteria

	log-likelihood	Deviance	AIC	BIC	AICc
Maximum-Likelihood	-11.575	33.817	27.150	27.544	29.150
Restricted Maximum-Likelihood	-10.793	21.586	25.586	25.744	27.986

Publication Bias

Publication Bias Assessment

Test Name	value	p
Fail-Safe N	146757.000	< .001
Begg and Mazumdar Rank Correlation	0.115	0.095
Egger's Regression	-0.370	0.711
Trim and Fill Number of Studies	25.000	.

Note. Fail-safe N Calculation Using the Rosenthal Approach